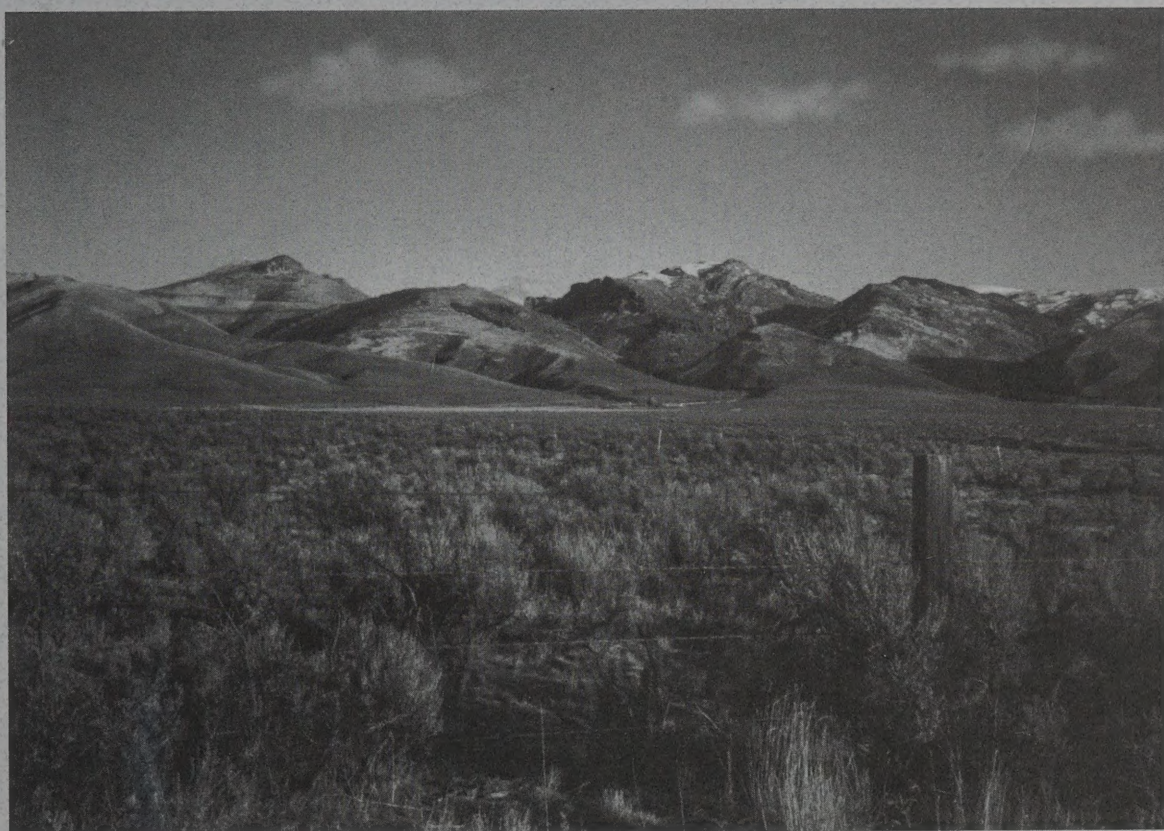
BLM LIBRARY
88076984

Jerritt Canyon Mine Expansion Project Final Environmental Impact Statement



United States Department of Agriculture
Humboldt National Forest
Elko County, Nevada

April, 1994

BLM Library
Denver Federal Center
Bldg. 50, OC-521
P.O. Box 25047
Denver, CO 80225

Photo Description: West side of Independence Range as seen from Highway 226 (Fall 1992).

#879344030

88076984

TD
195.
G6
J47
1994

JERRITT CANYON MINE EXPANSION PROJECT
Elko County, Nevada

Final Environmental Impact Statement

Lead Agency:
USDA-Forest Service
Humboldt National Forest

Cooperating Agencies:
USDI-Bureau of Land Management
Elko, NV

U.S. Army Corps of Engineers
Sacramento, CA

Nevada Division of Wildlife
Elko, NV

Nevada Division of Minerals
Carson City, NV

Elko County Commission
Elko, NV

Responsible Official:
John Inman
Forest Supervisor
Humboldt National Forest
976 Mountain City Highway
Elko, NV 89801

For Further Information Contact:
Don Carpenter
Mountain City Ranger District
P.O. Box 276
Mountain City, NV 89831
(702) 763-6691

Abstract:
This Final Environmental Impact Statement (FEIS) is written in response to a proposed Plan of Operations submitted by Independence Mining Company Inc. (IMC) to expand its existing gold mining operations at the Jerritt Canyon Mine on the Humboldt National Forest in Elko County, Nevada. The proposal includes construction of four open pit mines and associated waste rock dumps, soil stockpiles, ore stockpiles, haul roads and support facilities. The proposal would disturb approximately 3,000 acres of land of which about 400 acres have been disturbed by previous and on-going mining activities. Seven alternatives, including the No Action alternative and the proposed Project, are presented and analyzed for their effects on environmental resources in this FEIS. The alternatives have been developed in response to environmental resource issues and concerns identified through the public scoping process and interagency meetings.

The U.S. Forest Service's preferred alternative is Alternative C for the Burns Basin Expansion Area, Saval and Steer Operational Area; and Alternative F for the New Deep Area. IMC has confirmed to the U.S. Forest Service that it is economically and operationally feasible to use underground mining techniques for the New Deep ore body.

The Draft Environmental Impact Statement (DEIS) for this project was released for public review and comment on December 3, 1993. A 46 day comment period ended January 18, 1994. Public comments received on the DEIS resulted in a change of the Preferred Alternative, as well as other changes which respond to, and have been incorporated into this FEIS.

Equal Employment Opportunity Statement:

"The policy of the United States Department of Agriculture Forest Service prohibits discrimination on the basis of race, color, national origin, age, religion, sex, disability, familial status, or political affiliation. Persons believing they have been discriminated against in any Forest Service related activity should write to: Chief, Forest Service, USDA, P.O. Box 96090, Washington, DC 20090-6090."

BLM Library
Denver Federal Center
Bldg. 50, OC-521
P.O. Box 25047
Denver, CO 80225

Summary

Introduction

Independence Mining Company Inc. (IMC) has submitted a proposed Plan of Operations (POO) to the U.S. Department of Agriculture-Forest Service (USFS) to expand its existing gold mining operation at the Jerritt Canyon Mine in Elko County, Nevada. The proposed project would consist of four mine pits, associated waste rock dumps, haul roads, ore stockpiles, mine facilities, soil stockpiles, and drainage and sediment control structures. The proposed mining operation would be situated on private lands and National Forest System lands administered by the Mountain City Ranger District of the Humboldt National Forest. IMC has the statutory right, under the 1872 Mining Law as amended, to enter National Forest System lands for the purpose of conducting mineral exploration and mining activities, subject to the USFS approval of the POO and meeting the provisions of the National Environmental Policy Act (NEPA).

The USFS has determined that implementation of the POO would be a major federal action requiring preparation of an Environmental Impact Statement (EIS). The Final EIS (FEIS) describes components of reasonable alternatives to and environmental consequences of implementing the Project.

This summary briefly reviews the content of the FEIS as follows:

Chapter 1: Purpose of and Need for Action. This chapter describes the need for the proposed project and the decisions to be made. The project background, the environmental analysis process, public participation, the major issues and concerns raised during public and agency scoping, and the federal, state, and local permits required for the Project are also discussed.

Chapter 2: Alternatives Including the Proposed Action. This chapter describes the process by which alternatives were developed, describes IMC's Proposed Action and the other alternatives considered. It identifies existing operations, the management, mitigation and monitoring measures and compares alternatives on the basis of their environmental effects.

Chapter 3: Affected Environment. This chapter describes the physical and biological environmental resources and socioeconomic conditions that would be affected by the action alternatives.

Chapter 4: Environmental Consequences. This chapter analyzes and describes the potential environmental consequences of all alternatives.

1.0 Purpose of and Need for Action

Implementation of the mining activities described in the POO submitted by IMC is necessary for the continued and uninterrupted supply of gold bearing ore in an economically feasible manner to IMC's milling operations. The proposed Saval, Steer, New Deep and Burns Basin mining expansion areas would replace gold ore reserves that have been exhausted over the past twelve years at the existing Jerritt Canyon mining operations. This expansion would enable IMC to maintain current operations. Without implementation of the proposed project, IMC anticipates production and employment at IMC's mining and mineral processing operations would begin to decline in 1994 and totally cease sometime during 1996, based on current mine economics.

Implementation of the project would require a decision by the USFS and acquisition of applicable permits and authorizations from other agencies. The Humboldt National Forest Supervisor's decision to be made is to either approve the mine expansion activities as proposed by IMC or to approve an alternative course of action. A final POO would be developed to conform to the Forest Supervisor's selected action alternative. In addition to the Supervisor's decision and approval of the final POO, implementation of the project would require authorizing actions from other federal, state or local agencies including the US Army Corps of Engineers (Corps), US Department of Interior-Bureau of Land Management (BLM), the Nevada Divisions of Environmental Protection (NDEP), Water Resources, Health, and Historic Preservation, and the Elko County Department of Public Works.

The existing and proposed mining operations are located within the Independence Mountain Range approximately 50 miles northwest of Elko, Nevada. Mining operations began at the Jerritt Canyon Project after completion of the 1980 Jerritt Canyon Gold Mine and Mill FEIS and approval of the POO by the USFS and BLM. The proposed Saval and Steer mine areas were identified in the 1980 FEIS as areas with future mining potential. The New Deep mine area is essentially the extension of the existing West Generator pit, which was completed in 1993. The Burns Basin mine development began in 1988 and continues at present. The proposed project would provide for continued mine operations through 2005. The Project is expected to result in the creation of between 150 and 200 new job opportunities at IMC during mining.

During the scoping process, federal and state agencies, private individuals and organizations, and IMC identified issues and concerns regarding the proposed project and the alternatives to the proposed project. Public meetings were conducted in Elko, Reno, Mountain City and Tuscarora to assist in identifying public issues and agency concerns related to the project. Public and agency scoping identified the issues and concerns as listed in Table 1.2. These issues were narrowed to four focus issues to guide the development of alternatives: 1) water quality - potential for acid rock drainage, 2) waste rock dump design for stability, 3) reclamation potential - revegetation, and 4) mine economics - economic viability.

2.0 Alternatives Including the Proposed Action

The formulation of alternatives was a multiple-step process guided by the focus issues and post-mining land use objectives. Post-mining land use objectives established for the mine expansion by the USFS include providing for livestock grazing, wildlife habitat, recreational opportunities, public access, visual quality consistent with established classifications, and a stable post-mining watershed. Several alternatives were eliminated from detailed study because they did not respond to the focus issues, had significant environmental disadvantages, or were technically or economically infeasible. The Forest Supervisor approved the development of detailed analysis of seven alternatives, including the No Action Alternative.

Alternative A - No Action

Under the No Action Alternative, the USFS would not authorize the Proposed Action or any action alternative. Currently approved operations would continue until completion. The No Action Alternative is required by NEPA and serves as a baseline for evaluation of the action alternatives.

Existing mining and milling operations are divided into two separate geographic components, one for mining and one for processing. Mining occurs on approximately 3,137 acres of private and USFS-administered land in the Independence Mountains, primarily on the west side of the range. Gold ore is currently mined from five pits utilizing conventional open pit mining methods. Waste is hauled to various disposal sites, including waste rock dumps and partial pit backfill areas. Ore is hauled to the processing facilities, located on approximately 1,400 acres of BLM-managed land on the eastern flanks of the Independence Mountains.

Existing operations at the Jerritt Canyon Project are estimated to continue at current levels until 1994, at which point operations would begin to decline and completely shut down sometime before or during 1996. Employment, estimated at 600 persons in 1993, would decline accordingly.

Alternative B - Proposed Action

The Proposed Action for the Jerritt Canyon Mine Expansion is the development, operation and reclamation of the Saval, Steer, and New Deep mine areas and expansion of the existing Burns Basin mine area. Proposed operations are expected to result in production of gold from 20 million tons of ore. Ore would be processed at the existing mill and the milling waste would be deposited in the existing and approved tailings ponds. This alternative would result in about 2,966 acres of disturbance, which includes about 407 acres of existing disturbance.

Conventional open pit mining methods would be the primary means of developing the pits. Total area associated with pit development would be about 1,330 acres of which 308 acres have been previously disturbed. Underground mining methods may be utilized within

the pits during or after open pit mining to increase ore recovery. Active dewatering of the pits is not anticipated because the Saval, Steer and Burns Basin pits are located above the regional groundwater table and estimated pit inflow rates for New Deep are low. If active dewatering were necessary, the water would be utilized in mine operations or discharged to the surface or re-injected underground.

Approximately 1,084 million tons of waste rock would be deposited in waste rock dumps or in partial pit backfill areas. The majority of the waste rock dumps would be built as complete or partial valley-fills with angle of repose slopes in portions of the Jerritt Creek, Saval Canyon, Steer Canyon, and Burns Basin drainages. Approximately 1,308 acres of disturbance are associated with construction of the waste rock dumps. Under-dump drainage systems would convey surface water through the base of the dumps. The under-dump drainage system would consist of large rocks placed by gravity sorting of materials during dumping.

The haul road network required to develop the proposed Project would disturb about 184 acres. No changes to alignment or dimensions are anticipated for the haul roads outside of the Project area. Haul roads would range in width and would be constructed using a combination of cut and fill methods. The haul roads would be constructed and maintained to ensure adequate drainage and minimize damage to soil, water and other resources. Mine roads would be closed and reclaimed after mining unless authorized by the USFS to be left open.

Growth medium would be salvaged from portions of the pit area and stockpiled at various locations or redistributed directly. Approximately 119 acres would be covered by growth medium stockpiles. Low grade ore stockpiles would disturb an estimated 12 acres. New mine facilities would be constructed to support the New Deep mining operations. Sediment control structures would be constructed to trap sediment and control runoff, and are expected to disturb approximately 11 acres. Sediment ponds and traps would be removed after mining unless they are retained as post-mining water sources.

Alternative C

Alternative C was developed in response to concerns about waste rock dump stability, revegetation potential, visual quality, integrity of stream inflow and outflow under dumps, water diversion in Burns Creek, and partial pit backfilling. This alternative would result in about 3,099 acres of disturbance, of which approximately 437 acres have been previously disturbed.

Stability would be enhanced by adding terraces to waste rock dumps in specific locations and constructing and reclaiming some waste rock dump faces to ratios of 3H:1V (three feet horizontal to one foot vertical) and 2H:1V compared to the steeper angle of repose slopes proposed in Alternative B. The upstream side of the South Deep dump would be constructed as a single level approximately 130 feet high to promote gravity sorting of waste

rock and reduce potential for material compaction above the stream inflow point. Potential partial pit backfill locations are in the West Generator, Saval, and Burns Basin pits.

Alternative D

Alternative D was developed in response to the dump stability and reclamation potential focus issues. Under this alternative, all dump slope faces would be constructed and reclaimed to 3H:1V slopes, with the exception of three angle of repose dump slopes immediately southeast of the New Deep pit. This alternative would result in about 3,142 acres of disturbance, including 398 acres of previously disturbed area. Developing 3H:1V slopes would require constructing the dumps in multiple levels with angle of repose slopes, which would require additional haul roads to access the lower portion of the dumps. During reclamation, the angle of repose slopes would be reshaped to overall dump slopes of 3H:1V. The South Deep dump would be expanded farther downstream and in a different configuration from Alternative B, which would result in an undisturbed area southwest of the New Deep pit and new disturbance in a drainage to the west of Saval and Steer canyons.

Alternative E

Alternative E was developed to address the concerns about dump stability, reclamation potential and water quality as it relates to the under-dump drainage system. This alternative would result in about 2,952 acres of disturbance, of which approximately 395 acres have been previously disturbed. Alternative E is identical to Alternative D, except the upstream and downstream faces of the waste rock dumps would be developed at angle of repose to facilitate water flow into and out of the dumps. The upstream side of the South Deep dump would be constructed as a single level approximately 130 feet high similar to Alternative C to promote water flow through the dump.

Alternative F

This alternative was developed to address the potential to mine the New Deep deposit by underground mining methods. Surface disturbance for the Saval, Steer, and Burns Basin operations would be similar to that displayed in Alternative C, except that the dumps south of the Saval and Steer pits would have angle of repose slopes. Alternative F would result in about 2,041 acres of disturbance, which includes approximately 264 acres that have been previously disturbed. Surface disturbance associated with the underground mining of the New Deep pit would include up to three portals, five ventilation shafts, haul roads, facilities, and two small waste rock dumps. Some surface subsidence may occur as a result of underground mining.

Alternative G

This alternative was developed to display the combined effects of developing the New Deep orebody with both underground mining and surface mining techniques. Development of the Saval and Steer mine area and expansion of the Burns Basin pit would be the same

as in Alternative B. Alternative G would result in the disturbance of about 3,013 acres including approximately 408 acres of previously disturbed areas. Throughout the analysis, Alternative G impacts are assumed to be the total of the combined surface disturbances of Alternatives B and F, although it is unlikely that actual surface disturbance would be the total of both alternatives.

Management, Mitigation and Monitoring

Management constraints are the laws, regulatory requirements, Humboldt National Forest Land and Resource Management Plan (LRMP) standards, and guidelines which are in place that ensure that resource development takes place in an environmentally sound manner. Federal, state, and local government agencies administer the laws, regulatory programs, and guidelines for the protection of the environment. Permits and approvals are required for the implementation of the proposed project or any of the action alternatives. These permits are the means by which the appropriate regulatory agencies implement the laws, regulations and guidelines for which they are responsible. The proposed Project and the action alternatives have been designed and developed within the management constraints of these permits and approvals.

Mitigation measures and monitoring programs are a part of each action alternative. Mitigation measures are designed to offset or reduce adverse environmental impacts that cannot be avoided. Monitoring programs are designed to ensure that environmental safeguards are executed according to plan, necessary adjustments are made to achieve desired effects, and anticipated results are reviewed. These programs and measures are described in Sections 2.4 and 2.6 of this FEIS. Key components of the mitigation measures include the following:

- Off-site habitat improvement projects for sage grouse and mule deer.
- Off-site aspen stand planting and improvement projects.
- Off-site wetlands mitigation project.
- Waste rock characterization and handling program.
- Concurrent and final reclamation activities.

Key components of the monitoring programs include:

- Implementation of a Quality Control/Quality Assurance program.
- Implementation of a water quality and quantity monitoring program.
- Fisheries, macroinvertebrate and riparian monitoring in Burns Creek.

- Monitoring of fugitive dust emissions.
- Monitoring reclamation projects during and after completion.

Comparison of Alternatives

This section of the FEIS briefly summarizes and compares the environmental effects of the seven alternatives and includes a matrix chart of environmental effects by issues identified through public and agency scoping.

Effects to the physical, biological and socioeconomic environments would be incurred among all alternatives. One of the purposes of this FEIS is to display the differences in environmental effects among the alternatives. A summary of the effects of the alternatives in relation to identified issues is presented in Chapter 2. Additional discussion of the effects associated with the alternatives are included in Chapter 4. Qualitative analysis is provided where differences are not easily defined by quantitative measurement.

The fundamental differences among the alternatives are the use of 3H:1V waste rock dump slopes and underground mining of the New Deep ore body. Alternatives that include final reclamation to 3H:1V waste rock dump slopes were proposed with the intent of providing greater slope stability and greater revegetation potential. Underground mining of New Deep was proposed in two of the alternatives because it is a reasonably foreseeable future activity that warranted consideration and analysis. As indicated in Chapter 2 and discussed in the analysis in Chapter 4, use of underground mining methods in Alternative F would provide environmental benefits in relation to the other alternatives because there would be less disturbance associated with New Deep mining operations. However, costs of underground mining are greater, and results in less than full utilization of the mineral resource.

Environmental benefits of 3H:1V slopes are less easily quantified. The potential for revegetation is greater on 3H:1V slopes than on angle of repose slopes, and stability is greater. Additional benefits may be realized by other resources such as wildlife and vegetation. However, there is greater surface disturbance associated with construction and reclamation of waste rock dumps to 3H:1V slopes and costs are higher. All slopes under any alternative would meet minimum safety requirements.

Preferred Alternative

The USFS's preferred alternative is Alternative C for the Burns Basin Expansion Area and Saval and Steer Operational Area and Alternative F for the New Deep Area. IMC has confirmed to the USFS that it is economically and operationally feasible to use underground mining techniques for the New Deep ore body.

3.0 Affected Environment

This chapter provides a summary of the physical, biological, social and economic environments that would affect or may be affected by implementation of any of the alternatives for the Jerritt Canyon Mine Expansion. Existing conditions provide a baseline for the analysis of potential impacts that are examined in Chapter 4. The Project area (shown on Map 1.2) has been extensively studied since initiation of baseline surveys for the Jerritt Canyon Project Gold Mine and Mill EIS in 1978. This information base was updated by field studies, literature surveys and personal interviews conducted by an interdisciplinary group of resource specialists. Detailed information was collected within the Project area and additional updated information was collected in the general study area (shown on Map 1.2), a 44,000 acre area surrounding the Project area.

The condition of many of the existing resources are described in the FEIS according to criteria outlined in the *Independence Range Cumulative Effects Analysis (CEA) Draft Technical Guide*. The CEA model was developed by the USFS, NDOW, and several mining companies to provide a standardized approach for analyzing direct and cumulative impacts in the Independence Mountain Range. The CEA Draft Technical Guide describes the procedures, analytical models, and data bases to be used in evaluating the cumulative effects of mining proposals in combination with the effects of past and foreseeable future development. The CEA model defines the geographic area of analysis, or analysis "province," for a variety of resources. The CEA model also identifies the criteria used to measure impacts for each resource and identifies "thresholds of concern" (TOCs) to determine the significance of impacts. In the FEIS, existing resources are described in relation to TOCs and other CEA criteria in order to provide a basis of comparison for the potential impacts described in Chapter 4.

4.0 Environmental Consequences

This chapter analyzes and describes the potential environmental consequences of the action alternatives relative to the No Action Alternative, and provides the basis for comparison of the alternatives presented in Chapter 2. The discussion is focused on significant issues and concerns raised during scoping regarding the environmental resources and conditions.

Location and Topography

Changes in the steep, mountainous topography of the Independence Mountains would occur under all alternatives. Permanent or long-term changes are primarily associated with mine pits, waste rock dumps and haul roads. For all action alternatives, the Saval and Steer pits could be as much as 711 acres in size and 820 feet deep, and the Burns Basin expansion could be up to 94 acres in size and 340 feet deep. The New Deep pit would be up to 527 acres in size and 1,180 feet deep under all alternatives except Alternative F. Waste rock dumps under any alternative would result in a greater area of relatively flat

terrain than exists under natural topographic conditions. The area of disturbance for waste rock dumps ranges from 730 acres under Alternative F to 1,413 acres under Alternative D.

Mineral Resources

Effects to the mineral resource from all action alternatives except Alternative F would result in the excavation and relocation of approximately 1,084 million tons of waste rock and 20 million tons of ore. Under Alternative F, some of the mineral resources in the New Deep area would remain in the ground after mining as low grade ore that cannot be economically recovered. The configuration of the Alternative D waste rock dumps would make it difficult or impossible to access identified mineral resources west of the New Deep pit in the future.

Geochemistry

The results of static testing and kinetic testing indicate that there is a low potential for acid generation from waste rock derived from the Roberts Mountains and Hanson Creek Formations. Portions of the Snow Canyon Formation and most of the lower plate intrusive rocks have a moderate to high risk of generating acid. IMC has developed a program that would guide sampling and characterization of waste rock during mining as well as handling of materials that are determined to be acid-forming. With implementation of the waste rock characterization and handling program, the waste rock dumps developed in connection with the Jerritt Canyon Mine Expansion have a low potential to generate acid. Surface water monitoring would continue at the existing stations that are located downstream of the proposed waste rock dumps. Monitoring results and an analysis of trends in water chemistry would continue to be submitted to the USFS each year.

Geotechnical Considerations

The waste rock dumps under all action alternatives would be designed and constructed with minimum safety factors acceptable to the USFS. Potential effects of seismic events, foundation hazards, waste rock characteristics, and final slope steepness are the major geotechnical considerations affecting dump stability. Waste rock dumps with slopes of 3H:1V would typically have higher factors of safety than those with angle of repose slopes.

Soils

A loss of soil productivity would occur under all of the action alternatives. Soil productivity losses would be the greatest for Alternative G and the least for Alternative D. An adequate amount of soil exists within accessible portions of the pits for use as growth medium under each of the action alternatives. Growth medium would generally be redistributed to a minimum depth of eight inches on relatively flat dump tops, partial pit backfill surfaces, 3H:1V slopes, facility sites and the tops of low grade ore stockpiles abandoned at mine closure. Reclamation areas where growth medium is not redistributed represent a loss of soil productivity.

The reclamation potential focus issue is closely related to soils, since the application of growth medium to disturbed areas enhances revegetation success. The steepness of the final dump slopes is also directly related to revegetation capabilities and was called reclamation potential for the purposes of this analysis. Alternative G would have the lowest and Alternative D would have the highest reclamation potential.

Climatology and Air Quality

Effects to the baseline air quality would be limited primarily to particulates from mining, crushing and construction activities under all action alternatives. Previous air monitoring at the Jerritt Canyon project indicates that there would be negligible impacts to air quality from particulate emissions. The mitigation measures to be implemented would ensure that emissions would be within acceptable limits as determined by NDEP.

Surface Water Resources

Water quantity is expected to decrease as a result of the proposed mining operations, but the timing of water flow would be regulated to a certain degree by the waste rock dumps. Under the action alternatives, implementation would likely result in decreased water flow in Jerritt Creek and Burns Creek compared to pre-mining conditions because precipitation and runoff would be captured by the pits. Most of the precipitation and runoff intercepted by the pits would recharge the local groundwater system.

The action alternatives may result in a short-term increase in sediment yield as a result of surface disturbance during pit development, haul road and waste rock dump construction. This would be mitigated by construction of sediment control structures. With the exception of Alternative A, all the alternatives would result in less sediment yield after final reclamation than the pre-mining condition, based on computer modeling. This is primarily due to the development of pits which serve as sediment traps.

All of the action alternatives would result in new and/or additional changes to stream channel characteristics in Jerritt Creek and Burns Creek as waste rock dumps are created. Under-dump drainage systems that would form in the drainage bottoms would convey surface water through the lower part of the dumps. The dump in Jerritt Creek would be constructed with an under-dump drain that would be capable of passing the 100-year precipitation event and the predicted clay and silt sediment load in Jerritt Creek without clogging.

Groundwater Resources

The final elevation of the proposed New Deep pit bottom would be approximately 140 feet below the estimated regional groundwater elevation. Preliminary estimates of potential groundwater inflow rates range from 100 to 300 gallons per minute, and active dewatering of the pit would not be required. If water collects in the pit during mining it would either evaporate, infiltrate into the fractured rock in the bottom of the pit or be collected and used

in the mining operations. If dewatering were required, the water would be used by the mining operations, discharged to the surface, or re-injected into the groundwater system. After mining, groundwater may flow into the New Deep pit and may reach a maximum depth of 140 feet with a surface area as large as 19 acres. Under Alternatives F and G, sustained groundwater inflows into the New Deep underground workings are estimated to be 100 to 150 gpm and would be directed to sumps. Active dewatering of the underground workings is not anticipated. Water would collect in the workings after mining but would not flow out of the portals to surface waters.

As many as six springs and three seeps would be covered by waste rock dump construction or be affected by pit excavation. A short term reduction in spring flow could potentially occur at Niagara Spring. If a reduction of flow occurs that impairs the use of Niagara Spring and is attributable to mining, appropriate mitigation measures would be implemented. No reduction in flow from Van Norman Spring is expected to occur as a result of mining the New Deep pit.

Wetlands

Wetlands would be affected under all of the action alternatives. The mine components were designed and planned to avoid and minimize disturbance to wetlands to the extent practicable. The area of impacted wetlands would range from 2.89 acres under Alternative F to 3.82 acres under Alternative D. A mitigation and monitoring plan for impacted wetlands has been developed in coordination with resource agencies and a final plan was approved by the Army Corps of Engineers (Corps). Off-site wetland mitigation has been proposed by IMC for any action alternative selected.

Aquatic Resources and Fisheries

Surface water impacts that would directly affect aquatic and fisheries resources include decreases in water quantity, timing of flow, and effects to water quality due to changes in sediment yields and the potential for acid generation. After reclamation and revegetation, reduced sediment yields and longer duration of flows may occur.

Vegetation

No threatened, endangered, or sensitive plant species have been identified in the Project area and no effects to such plant species are anticipated as a result of any action alternative.

During the life of the Project, there would be a modification in plant species composition, age classes, heights and canopy densities within disturbed areas. Once reclamation activities are completed and vegetation becomes re-established, new community types consisting of a mixture of native and introduced grasses, forbs and shrubs would be created. Over time, first generation plantings of aspen and shrubs would mature and reproduce. Plant species from adjacent undisturbed areas would also colonize disturbed areas, resulting in diversity similar to that of undisturbed areas. Alternative F would have

the least impact (1,777 acres) to existing vegetation resources and Alternative D would have the greatest impact (2,744 acres) to existing vegetation resources. Long term cumulative effects would result from unrevegetated disturbances such as pit highwalls and armored angle of repose slopes. For all practical purposes, this loss of vegetation is an irreversible and irretrievable loss of the vegetative resource.

Most of the aspen communities that would be disturbed under any action alternative are located in the Saval and Steer mine areas and all action alternatives have very similar disturbances in this area. Therefore, the amount of aspen disturbed does not vary substantively between action alternatives, and ranges from 614 acres under Alternative F to 640 acres under Alternative C.

Wildlife

A direct short-term loss of wildlife habitat would occur upon implementation of any of the action alternatives. Direct disturbance to wildlife habitat from the action alternatives ranges from a low of 1,777 acres under Alternative F to 2,744 acres under Alternative D. Indirect impacts to wildlife in the form of temporary displacement would also result from project implementation. In the long-term, successful revegetation would result in habitat diversity similar to adjacent undisturbed upland areas.

<u>Threatened, Endangered, Candidate and Sensitive Species</u>. Bald eagles may occasionally migrate through the Project area annually. Peregrine falcons rarely pass through the area. Impacts to these two endangered species would be negligible. There would be no additional impact to the only threatened species in the vicinity, the Lahontan cutthroat trout. Decreased flows and short term increases in sedimentation could have some adverse impacts for potential red band trout habitat in Burns Creek, a candidate species. No other candidate species are anticipated to be significantly effected. There may be a long term loss of potential habitat for the flammulated owl, a USFS-designated sensitive species.

<u>Management Indicator Species</u>. Three historic goshawk nests would be removed by proposed disturbance under all action alternatives. Disturbance would also occur to goshawk habitat in the Project area under all action alternatives. All action alternatives would impact high to moderate value mule deer winter range. Direct impacts would range from approximately 1,790 acres under Alternative F to approximately 2,854 acres under Alternative D. Impacts to mule deer summer range and fawning habitat would also occur under all action alternatives. All action alternatives would impact sage grouse brooding habitat in both Burns and Jerritt Creek watersheds.

Land Use

Under all action alternatives, land use within the Project area would shift to predominately mining during the operations phase of the Project. Post-mining land uses

for all alternatives would generally reflect pre-mining uses, although changes in topography would prohibit an exact duplication of pre-mining conditions.

Livestock Grazing

All action alternatives would affect some forage areas in the Schmitt Creek and Jerritt Canyon cattle and horse grazing allotments. There would be a 63 percent reduction in animal months in the Jerritt Canyon allotment during the life of the mine under Alternatives B, C, D, E, and G. Under Alternative F, the reduction in animal months to the Jerritt Canyon allotment would be 29 percent. There would be no reduction in animal months to the Schmitt Creek allotment under any action alternative. IMC would maintain about 23 miles of allotment boundary fences surrounding the existing and proposed mining operations.

Recreation

Effects to recreational opportunities would occur under all of the action alternatives. The existing closure areas would be expanded to the west along Jerritt Creek about 1.5 miles for public safety purposes. Hunting access would be restricted in this area, but would remain open outside of the closure area. There would be no direct impacts to recreational fishing.

Public Access

Relocating the road closures along the Jerritt Creek Road (#875) and Arana Road to the west would result in additional areas that are totally closed for public safety reasons. The majority of the expansion area is not readily accessible under existing conditions due to the limited number of access routes and the steepness of the terrain. The existing closure area is about 7,347 acres in size.

After mining and reclamation, the closure area would be re-opened with some access restrictions for safety. Some of the mine roads would be left open once the final closure operations are completed.

Socioeconomics

Under Alternative A, the existing mining operations would begin to decline in 1994 and cease sometime before or during 1996. Socioeconomic impacts would include resultant losses in the community in terms of jobs, revenues and real estate values.

The rapid growth rates of the 1980s have subsided with annual increases in Elko County population projected at 3.8 percent in 1993-94, then slowing to less than two percent per year through 1998. Elko County population would probably increase as a result of implementation of the Proposed Action. It is estimated that 43 percent of the 155 (under Alterative F) to 270 (under Alternative G) new employees required for the project would be hired locally. An additional 109 to 190 jobs would be created in support and service

businesses. Sustained employment at the Jerritt Canyon Mine along with new job opportunities would contribute to community stability.

Local government financial resources are especially sensitive to the volume of local economic activity and continued revenues from sales and use taxes, property taxes and net proceeds of mine taxes. Adverse effects to local government financial resources would be greatest under Alternative D and least under Alternative B. Many capital improvement projects which have been undertaken to expand local infrastructure, such as the ten-year pay-as-you go school building program, are dependent on continued payment of these taxes. Existing crowded conditions in some public schools in Elko may continue until new facilities are constructed.

The rental housing market would probably continue to be tight, particularly in Elko over the next several years, regardless of the proposed expansion. Existing and new single-family dwellings and mobile homes are expected to meet most of the anticipated additional housing needs associated with this project. Real estate values would likely continue to reflect local supply and demand.

Visual Resources

Changes to the visual resource would occur as changes to topography and vegetative cover. Implementation of any action alternative would not result in any change to the visual quality objectives (VQOs) established by the USFS for the area. Under Alternative A, there would be no new impacts to visual resources other than those already approved for existing operations. Changes to visual quality would be similar for all action alternatives except F. Portions of the disturbance would be seen from the Independence Valley, but due to the viewing distances, differences among the alternatives would not be substantial. Once public access is reopened, more of the disturbance would be visible from within the Project area and those alternatives with a greater disturbance would result in a greater area of impact to the pre-mining visual resource.

Cultural Resources

Under Alternative A, any impacts to cultural resources would be those that have already been identified and approved for existing operations. In order to avoid damage to unidentified sites, IMC contributes funds for the Humboldt National Forest to inventory and evaluate areas before they are developed. There are no sites identified as significant or unevaluated that would fall within the proposed disturbance or within a 300 foot buffer around the proposed disturbance. Consultations with descendants of the Tosawihi, the native people who historically used the area, indicate there would be no direct or indirect impacts on Native American traditional sacred areas under any action alternative.

Table of Contents

Photo Description: View of west side of the Independence Mountains from Highway 226 (Fall 1992).

JERRITT CANYON MINE EXPANSION PROJECT
Draft Environmental Impact Statement

Table of Contents

Chapter 3: Affected Environment

Chapter 4: Environmental Consequences

Chapter 5: List of Preparers

Chapter 6: List of Agencies, Organizations and Persons to Whom Copies of this Statement Were Sent and DEIS Comments and Responses

Supplemental Information

Appendices

List of Tables

List of Figures

List of Maps

List of Abbreviations

ABA . . . . Acid-Base Accounting
AC . . . . Additional Costs
AP . . . . Acidification Potential
AUM . . . . Animal Unit Months
BLM . . . . United States Bureau of Land Management
CEA . . . . Cumulative Effect Analysis
CFS . . . . Cubic Feet Per Second
Corps . . . . United States Army Corps of Engineers
DEIS . . . . Draft Environmental Impact Statement
EA . . . . Environmental Assessment
EIS . . . . Environmental Impact Statement
EPA . . . . United States Environmental Protection Agency
FEIS . . . . Final Environmental Impact Statement
FOS . . . . Factor of Safety
FPS . . . . Feet Per Second
GIS . . . . Geographical Information System
GPM . . . . Gallons Per Minute
IDT . . . . Inter-disciplinary Team
IMC . . . . Independence Mining Company Inc.
IME . . . . IME Wetlands Consultants
LRMP . . . . Land and Resource Management Plan
MCE . . . . Maximum Credible Earthquake
MSA . . . . Mine Services and Administration Site (IMC)

MWMP . . . . Meteoric Water Mobility Procedure
NDEP . . . . Nevada Division of Environmental Protection
NDOM . . . . Nevada Division of Minerals
NDOW . . . . Nevada Division of Wildlife
NENDA . . . . North East Nevada Development Authority
NEPA . . . . National Environmental Policy Act
NNNPS . . . . Northern Nevada Native Plant Society
NSPS . . . . New Source Performance Standards
NP . . . . Neutralization Potential
PFA . . . . Post Fledgling Area (for goshawks)
POO . . . . Plan of Operations
QA/QC . . . . Quality Assurance/Quality Control
ROD . . . . Record of Decision
SCS . . . . United States Soil Conservation Service
SPCCP . . . . Spill Prevention Control and Countermeasure Plan
TDS . . . . Total dissolved solids
TOC . . . . Threshold of Concern
TSS . . . . Total suspended solids
USFS . . . . United States Forest Service
USFWS . . . . United States Fish and Wildlife Service
USGS . . . . United States Geological Survey
VQO . . . . Visual Quality Objective

Chapter 1

Purpose of and Need for Action

Photo Description: Overall view of existing operations in Jerritt Canyon (Summer 1993).

CHAPTER 1
PURPOSE OF AND NEED FOR ACTION

1.0 PURPOSE OF AND NEED FOR ACTION

1.1 Introduction

In January 1993, Independence Mining Company Inc. (IMC) submitted to the US Department of Agriculture-Forest Service (USFS), Humboldt National Forest a proposed Plan of Operations (POO) to expand its existing gold mining operation at the Jerritt Canyon Mine in Elko County, Nevada (Map 1.1 and Map 1.2). The proposed mining operation area (Project area) is situated on private lands and on public lands administered by the Mountain City Ranger District of the Humboldt National Forest (Map 1.3). The project would involve disturbance of approximately 2,966 acres of land including four mine pits, associated waste rock dumps, a haul road system, ore stockpiles, mine facilities, soil stockpiles and drainage and sediment control structures. Other activities may include development and condemnation drilling within and next to the mine areas and underground mining to maximize gold ore recovery.

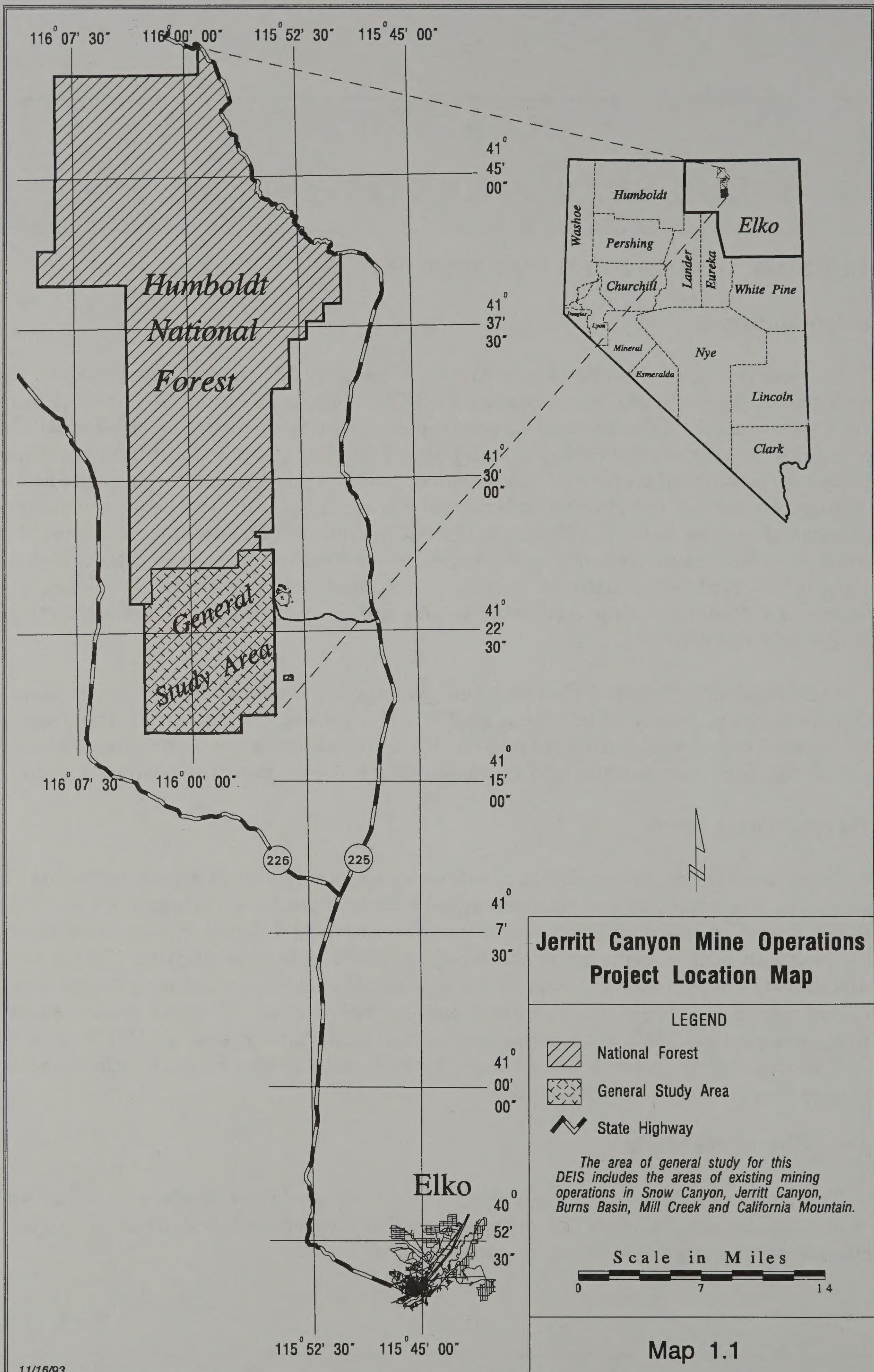
The Humboldt National Forest is the lead agency responsible for the preparation of the Environmental Impact Statement (EIS). The Forest Supervisor is the responsible official for the project and is directly responsible for conducting the environmental analysis, preparing the EIS, and making and implementing a decision on the proposed action.

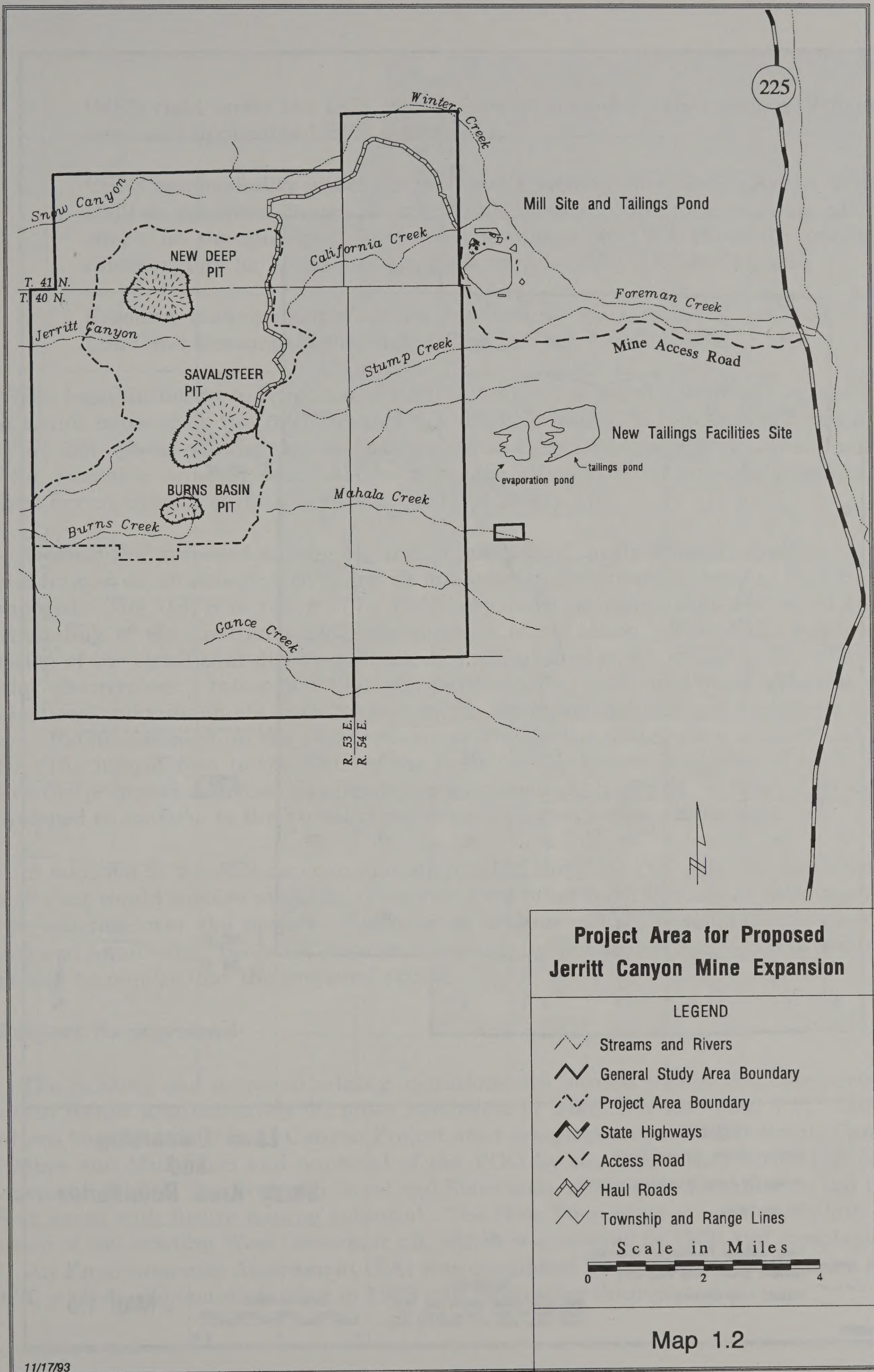
1.2 Purpose and Need

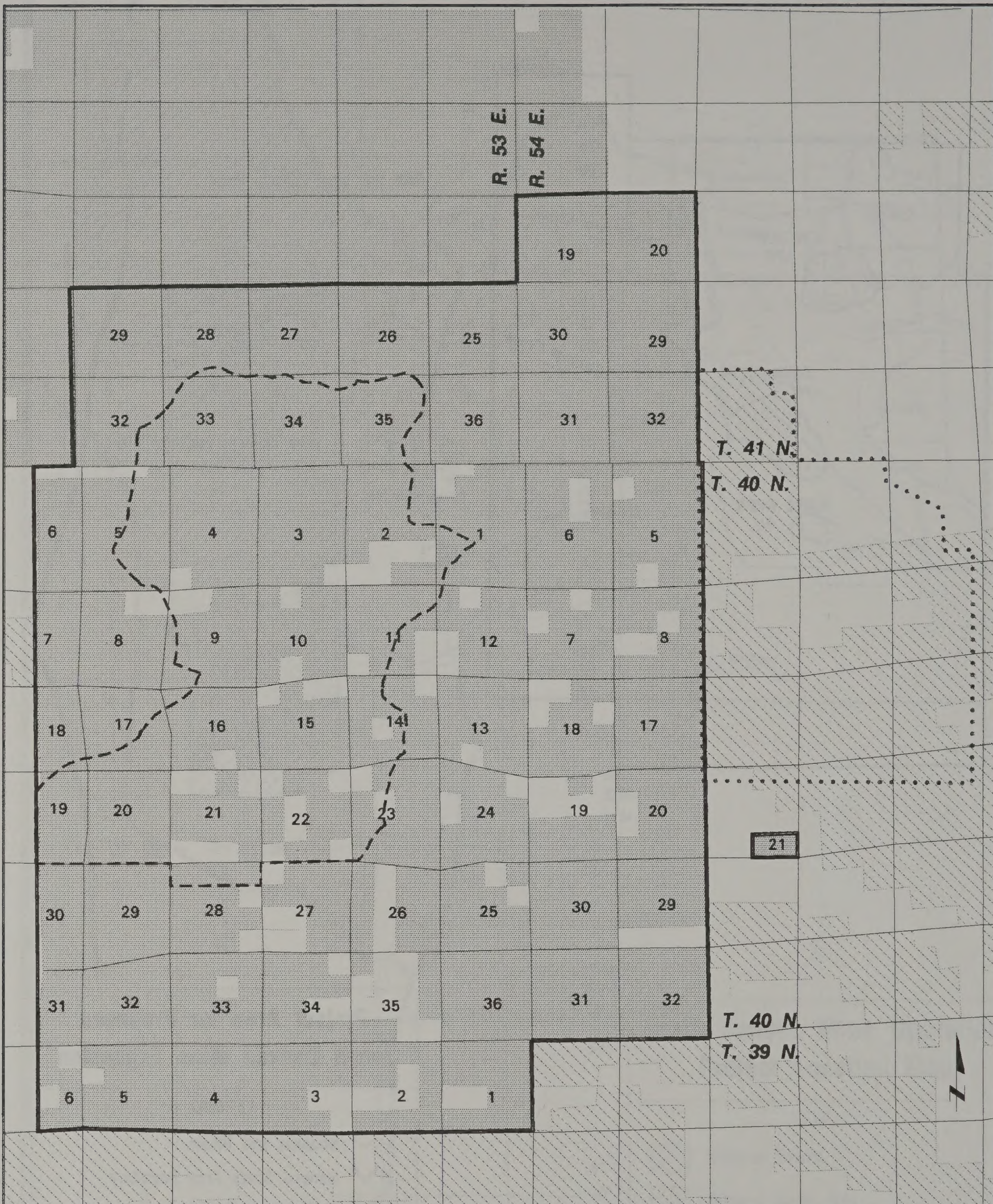
Implementation of the mining activities described in the POO submitted by IMC is necessary for the continued and uninterrupted supply of gold bearing ore in an economically feasible manner to their milling operations. The proposed Saval, Steer, New Deep, and Burns Basin mining expansion areas would replace gold ore reserves that have been exhausted over the past twelve years at the existing Jerritt Canyon mining operations. This expansion would enable IMC to maintain current operations. Without implementation of the proposed project, IMC anticipates production and employment at IMC's mining and mineral processing operations would begin to decline in 1994 and cease sometime during 1996, based on current mine economics.

1.3 Decision to be Made

The Humboldt National Forest Supervisor's decision to be made is to either approve the mine expansion activities as proposed by IMC (proposed action) or to approve an alternative course of action giving consideration to:


116° 07' 30"
116° 00' 00"
115° 52' 30"
115° 45' 00"
41° 45' 00"
41° 37' 30"
41° 30' 00"
41° 22' 30"
41° 15' 00"
41° 7' 30"
41° 00' 00"
40° 52' 30"
Humboldt National Forest
General Study Area
226
225
Elko
Humboldt
Washoe
Pershing
Elko
Churchill
Lander
Eureka
White Pine
Lyon
Douglas
Mineral
Nye
Esmeralda
Lincoln
Clark
Jerritt Canyon Mine Operations
Project Location Map
LEGEND
National Forest
General Study Area
State Highway
The area of general study for this DEIS includes the areas of existing mining operations in Snow Canyon, Jerritt Canyon, Burns Basin, Mill Creek and California Mountain.
Scale in Miles
0
7
14
Map 1.1
11/16/93


225
Winters Creek
Snow Canyon
Mill Site and Tailings Pond
California Creek
NEW DEEP PIT
T. 41 N.
T. 40 N.
Foreman Creek
Jerritt Canyon
Stump Creek
Mine Access Road
SAVAL/STEER PIT
New Tailings Facilities Site
tailings pond
evaporation pond
BURNS BASIN PIT
Mahala Creek
Burns Creek
Gance Creek
R. 53 E.
R. 54 E.
N
Project Area for Proposed Jerritt Canyon Mine Expansion
LEGEND
Streams and Rivers
General Study Area Boundary
Project Area Boundary
State Highways
Access Road
Haul Roads
Township and Range Lines
Scale in Miles
0
2
4
Map 1.2
11/17/93



LEGEND

- National Forest System Lands
- Bureau of Land Management Lands
- Private Lands
- New Tailings Facility EA Boundary
- General Study Area Boundary
- Project Area Boundary

03/22/94

SOURCES:
USDA Forest Service Visitor's Map; 1990
Study Area For New Tailings Facility EA:
(USDI - BLM 1993 EA - BLM/EK/PL-93/027

Land Ownership and Study Area Boundaries

Scale in Miles
0 1 2 MI.

Map 1.3

a) IMC's right under the 1872 Mining Law as amended, other applicable federal laws, and applicable USFS regulations,

b) USFS responsibility under the National Environmental Policy Act (NEPA) of 1969 as amended, to use all practicable means to minimize possible adverse effects on the quality of human environment (40 CFR 1500.2(f)), and with consideration for social and economic impacts (40 CFR 1508.14) and

c) Resource management direction provided by the Humboldt National Forest Land and Resource Management Plan (USDA, USFS 1986b).

The legal authority to require and modify locatable mineral operations on National Forest Lands is based on the 1897 Organic Act and is described in regulations found in 36 CFR Part 228. These mining regulations emphasize Forest Service authority to require a POO for locatable mineral proposals to minimize adverse environmental impacts on National Forest System surface resources (36 CFR 228.1).

Because the proposed mining expansion may significantly affect the quality of the physical human environment, NEPA and its implementing regulations require that an EIS be prepared. The USFS is required by NEPA to make decisions that are based on an understanding of the environmental consequences of an action. This FEIS provides a discussion of the significant direct, indirect, and cumulative effects of the proposed action and the alternatives. Interested and affected agencies, state and local governments, organizations and individuals were involved in the planning, analysis and decision-making process. Public comment on the DEIS was considered in the preparation of the Final EIS (FEIS). The information in the FEIS is the basis for the Forest Supervisor's decision to approve the proposed action or an alternative examined in the FEIS. A final POO would be developed to conform to the Forest Supervisor's selected action alternative.

In addition to the EIS decision and approval of the final POO, the implementation of the project would require authorizing actions from other federal, state or local agencies with jurisdiction over the project. Authorizing actions include environmental permits, licenses and approvals. Table 1.1 summarizes the principal authorizing actions that may potentially be required for the proposed action.

1.4 Project Background

The existing and proposed mining operations are located within the Independence Mountain Range approximately 50 miles northwest of Elko, Nevada (Map 1.1). Mining operations began at the Jerritt Canyon Project after completion of the 1980 Jerritt Canyon Gold Mine and Mill FEIS and approval of the POO by the USFS and Bureau of Land Management (BLM). The proposed Saval and Steer mine areas were identified in the 1980 FEIS as areas with future mining potential. The New Deep mine area is essentially the extension of the existing West Generator pit, which was started in 1986 and completed in 1993. An Environmental Assessment (EA) was completed for the Burns Basin mine area in 1986, with development starting in 1988 and continuing through today.

Table 1.1
Summary of Permits & Approvals Potentially Required for the Jerritt Canyon Mine Expansion

Agency/Permit	Facet of Project
FEDERAL	
U.S. FOREST SERVICE	
Approval of Plan of Operations	Detailed operating plans to implement the USFS Record of Decision on the EIS
U.S. ARMY CORPS OF ENGINEERS	
Section 404 Permit	Any filling or dredging of wetlands and waters of the U.S.
BUREAU OF LAND MANAGEMENT	
Approval of Plan to Expand Tailings Facility	The new tailings facility has been approved up to a 10 million ton capacity. Mine expansion would require 20 million tons of additional capacity.
STATE	
NEVADA DIVISION OF ENVIRONMENTAL PROTECTION	
Air Quality Permit	Fugitive dust associated with surface disturbance and stationary source emissions.
Authorization to Discharge	Discharge of water to surface water (i.e. pit dewatering)
General Discharge Permit - Storm Water	Discharge of stormwater runoff
Underground Injection Control Permit	Subsurface disposal of water from dewatering operation
Water Pollution Control Permit	Discharge and seepage potential of mine and waste rock dumps, ore processing and tailings deposition, surface and groundwater quality
Reclamation Permit for Mining Operations	Surface disturbing components of the project
Solid Waste Disposal	Disposal of solid, non-toxic wastes
NEVADA DIVISION OF WATER RESOURCES	
Water Appropriation Permit	Use of surface and ground water
Dam Safety Permit	Any dam over 20 feet in height or impounding more than 20 acre-feet of water
NEVADA DIVISION OF HEALTH	
Sewage Disposal System Permit	Sewage disposal systems associated with mine facilities
Public Water System Permit	Drinking water
NEVADA DIVISION OF HISTORIC PRESERVATION	
Review/Oversight	Cultural resources clearances
STATE MINE INSPECTOR	
Notification	Opening or closing of mines
LOCAL	
ELKO COUNTY DEPARTMENT OF PUBLIC WORKS	
Building Permit	Surface facilities

Note: List is not all inclusive

The Jerritt Canyon operations are divided into two separate geographic components, one for mining and one for processing. Mining occurs on private and National Forest System lands in the Independence Mountains, primarily on the western flanks. The mining operations are located on approximately 3,000 acres of land in Townships 40 and 41 North, Ranges 53 and 54 East. The mill processing facilities are located on approximately 1,400 acres of BLM-managed land in Townships 40 and 41 North, Range 54 East, on the eastern flanks of the Independence Mountains. The mining and milling operations are connected by a haul road (Map 1.2).

The Jerritt Canyon Gold Mine and Mill FEIS and POO provided the basis for mining operations conducted over the past thirteen years in the Project area. During that time, amendments and modifications to the original POO were made with USFS approval based on supplemental EAs. By incorporating these and other documents by reference, this FEIS will eliminate repetitive discussion of issues and conditions already disclosed. A list of those items incorporated by reference is included in the references section of this document. Documents incorporated by reference are available for review at the Humboldt National Forest District Office in Mountain City, Nevada.

This FEIS is tiered to the Humboldt National Forest LRMP. The FEIS follows guidance provided in the LRMP for the management and use of the Humboldt National Forest, including locatable mineral exploration and development activities. Management direction and consistency with the LRMP has been considered as part of all project alternatives.

1.5 Environmental Analysis Process

Technical Participation

Several government agencies were invited to participate in the project. The BLM is a cooperating agency because the mill site is located on lands they manage. In addition, U.S. Army Corps of Engineers (Corps), Nevada Division of Minerals (NDOM), Nevada Division of Wildlife (NDOW) and Elko County Commission are also cooperating agencies. The U.S. Fish and Wildlife Service (USFWS), U.S. Environmental Protection Agency (EPA) and Nevada Division of Environmental Protection (NDEP) are participating as technical advisors and reviewers in areas of their technical expertise and/or regulatory authority. Other agencies involved in the review of the proposed operations for permits or other approvals are listed in Table 1.1.

An Interdisciplinary Team (IDT) of technical specialists from the USFS and BLM was established to integrate the environmental analysis from a variety of disciplines including physical, biological, economic and social sciences. The IDT was responsible for identifying the issues related to the proposed action, developing alternatives to be analyzed, and guiding and participating in the collection, evaluation and presentation of data leading to the FEIS.

GeoResearch, Inc., is the third-party consultant responsible for preparing the EIS under the direction of the USFS. This group consists of resource specialists approved by the USFS. They were responsible for collecting and analyzing resource data, estimating effects, evaluating alternatives, recommending preliminary mitigation measures and writing the EIS under the supervision and review of the USFS. IMC is responsible for funding the third-party consultant and had substantial involvement in providing technical information.

EIS Process

The EIS process prescribed by NEPA consists of scoping, alternative development, analysis, documentation, and implementation of the decision, including any monitoring that may be required.

The purpose of scoping is to determine the scope of issues to be addressed and to identify the significant issues related to the proposed action. Public, federal, state and local government agency participation is a key component of scoping.

A series of analysis procedures is used to assess the nature and significance of the physical, biological, social and economic effects of the proposed action and its reasonable alternatives. Alternatives must provide different responses to important issues identified in the scoping process. The direct, indirect and cumulative effects of each alternative, including an alternative of no action, must be considered and evaluated.

The results of the scoping and analyses are documented in the FEIS. Mandatory documentation for preparation of an EIS includes a Notice of Intent to prepare an EIS, and notices of availability for the DEIS, FEIS, and Record of Decision (ROD) signed by the decision maker.

The ROD may be implemented no sooner than five business days following the end of the 45 day appeal period. The appeal period would begin on the date the legal notice for the ROD is published. Mitigation and monitoring programs described in the FEIS, ROD and POO would ensure that environmental safeguards are executed according to plan, anticipated results are achieved and/or changes are made to ensure they are achieved.

1.6 Public Participation

Public involvement is an important part of scoping and the environmental analysis process. It ensures that the general public actively participates in the decision-making process and communicates their concerns so that these concerns are addressed in the EIS. In addition, involvement by local governments helps them anticipate the impacts and benefits which could occur from the project and make necessary plans and changes in public policy.

To encourage public participation, the USFS utilized a variety of techniques including information mailed to 270 interested parties, public meetings and open houses. An updated

mailing list of citizens, government agencies and interest groups was prepared for mailing Project EIS information.

The USFS began the scoping process by publishing a Notice of Intent to prepare an EIS which appeared in the Federal Register, Vol. 58, No. 37, on February 26, 1993, and again on March 5, 1993. A letter and scoping statement were mailed to individuals, groups, and other entities. These documents presented the tentative issues and preliminary alternatives, and requested participation in the scoping process. A formal public meeting was held in Elko on March 8, 1993, and informal open houses were held in Reno, Mountain City and Tuscarora, Nevada on March 15, 17, and 18, 1993, respectively. Approximately one hundred individuals attended the public meeting in Elko, and approximately fifty persons attended the informal open houses. Written comments concerning the proposed activity and the associated issues were requested by April 10, 1993. Thirty-seven written comments were received from the general public.

The notice of availability of the DEIS was published in the Federal Register on December 3, 1993, with a comment due date of January 18, 1994. The DEIS was delivered to persons, organizations, government agencies, and other entities requesting to review the draft document.

Informal public meetings on the DEIS utilizing a format of question-answer and general discussion were held in Reno, Elko and Tuscarora, Nevada on January 4, 5, and 6, respectively.

The DEIS comment period ended on January 18, 1994, and 27 comment letters were received. Some letters were submitted after the close of the public comment period, and therefore did not receive official responses. However, they were reviewed and considered and are included in Chapter 6 of the FEIS. Based on the comments received, various sections of the document have been revised or updated. The responses to comments on the DEIS are included in Chapter 6 of this FEIS.

1.7 Issues and Concerns

Federal and state agencies, private individuals and organizations, and IMC have raised a number of issues and concerns regarding the proposed Project and its alternatives throughout the course of the NEPA process. These included potential adverse environmental effects, technical and engineering feasibility considerations, and positive opportunities which could develop as a result of the proposed Project. The issues helped establish the scope of the environmental analysis and keep it focused on the resources of most importance to the public and agencies.

Comments received throughout the scoping process were recorded and the issues and concerns were summarized and organized under general resource topic headings as displayed in Table 1.2. As part of the process of summarizing issues, some issues were consolidated into broader issue statements. The issues in Table 1.2 are the significant issues that are analyzed in this FEIS. Also shown at the end of Table 1.2 are key issues

that were developed by the IDT to focus alternative development. These "focus" issues overlap with the other issues in Table 1.2. A more detailed discussion of focus issues and other methodology used to develop alternatives is included in Chapter 2.

Table 1.2
Issues Identified in Scoping
(Key to Tracking Issues in the FEIS)

Issue	EIS Document Section
Wildlife	
1. Potential effects on mule deer habitat.	Wildlife - Chapter 4
2. Potential effects on goshawk habitat.	Wildlife - Chapter 4
3. Potential effects on sage grouse brooding habitat.	Wildlife - Chapter 4
4. Potential effects on any threatened, endangered or sensitive animal species.	Wildlife - Chapter 4
5. Potential effects on golden eagles.	Wildlife - Chapter 4
6. Potential effects on upland game birds, furbearers and trout.	Wildlife - Chapter 4
Wetlands	
1. Potential loss of wetlands and mitigation for no net loss.	Wetlands - Chapter 4
Vegetation	
1. Potential effects on vegetative biodiversity.	Vegetation - Chapter 4
2. Potential effects on any threatened, endangered or sensitive plant species.	Vegetation - Chapter 4
3. Potential for aspen fragmentation.	Vegetation - Chapter 4 Wildlife/Cavity Nesters - Chapter 4
Livestock Grazing	
1. Potential effects on the current carrying capacity of the affected allotments.	Land Use - Livestock Grazing - Chapter 4
Water Quality and Quantity	
1. Potential for water impoundment.	Surface Water and Groundwater - Chapter 4
2. Potential for acid rock drainage.	Geology - Chapter 4 Surface Water - Chapter 4 Groundwater - Chapter 4
3. Potential loss of water flow to the surface at Niagara Spring and Van Norman Spring.	Groundwater - Chapter 4
4. Potential for sedimentation of surface water from erosion of roads, pits, and dumps.	Surface Water - Chapter 4
5. Potential effects on discharge and timing of discharge and potential snow deposition.	Surface Water and Groundwater - Chapter 4
6. Potential effects on the quality of surface water and groundwater.	Surface Water and Groundwater - Chapter 4

Table 1.2, Continued
Issues Identified in Scoping
(Key to Tracking Issues in the FEIS)

Issue	EIS Document Section
Recreation	
1. Potential effects on hunting and fishing.	Wildlife and Recreation - Chapter 4 Public Access - Chapter 4
2. Potential effects on visual resources.	Visual Resources - Chapter 4
Cultural Resources	
1. Potential effects on cultural resources.	Cultural Resources - Chapter 4
Socioeconomics	
1. Potential effects on employment.	Socioeconomics - Chapter 4
2. Potential effects on Elko County.	Socioeconomics - Chapter 4
3. Potential effects to tax structure and revenues to the County.	Socioeconomics - Chapter 4
4. Community stability - length of operations.	Socioeconomics - Chapter 4
Reclamation	
1. Potential disturbance area over the life of the Project.	Chapter 2
2. Reclamation and revegetation methods.	Vegetation - Chapter 4, Soils - Chapter 4
3. Stability of reclaimed and revegetated sites.	Geology - Chapter 4
4. Post mining land uses.	Land Use - Chapter 4, Soils - Chapter 4
Mine Economics	
1. Potential effects of the various alternatives on the ability of the mine operator to continue operations.	Chapter 2, Socioeconomics - Chapter 4
2. Costs and benefits of alternatives considered.	Chapter 2
3. Cost of mitigation.	Chapter 2
Air Quality	
1. Fugitive dust abatement.	Air Quality - Chapter 4
Focus Issues	
1. Water Quality - Acid Rock Drainage Potential.	Geochemistry, Surface Water, Groundwater - Chapters 3 & 4
2. Waste Rock Dump Design for Stability.	Geotechnical - Chapters 3 & 4
3. Reclamation Potential - Revegetation.	Soils, Vegetation - Chapter 4
4. Mine Economics - Economic Viability.	Chapter 2, Socioeconomics - Chapter 4

Chapter 2

Alternatives Including the Proposed Action

Photo Description: Pit operations in Burns Basin (Summer 1993).

CHAPTER 2
ALTERNATIVES INCLUDING THE PROPOSED ACTION

2.0 ALTERNATIVES INCLUDING THE PROPOSED ACTION

2.1 Introduction

This chapter describes the no action, proposed action, and five other alternatives. Alternatives were developed to respond to the various issues raised during scoping and to meet the purpose and need described in Chapter 1. This chapter also summarizes the environmental consequences of the alternatives, which are described in more detail in Chapter 4.

Detailed discussions of the following topics are presented in Chapter 2:

Section 2.2 Formulation of Alternatives

Section 2.3 Existing Operations

Section 2.4 Alternatives Considered for Detailed Study

Section 2.5 Alternatives Eliminated From Detailed Study

Section 2.6 Management, Mitigation and Monitoring

Section 2.7 Comparison of Alternatives

Section 2.8 Preferred Alternative

2.2 Formulation of Alternatives

The formulation of alternatives was a multiple-step process guided by significant issues and post-mining land use objectives. Meetings involving members from the USFS, BLM, NDOW, NDOM, Elko County Commission, Corps, and IMC were conducted to develop and finalize alternatives. Issues identified through public and agency scoping were narrowed to four focus issues to guide the development of alternatives. The Forest Supervisor approved the development of detailed analysis of the seven alternatives examined in this FEIS based on their ability to respond to the issues and to meet specified post-mine land use objectives.

The range of alternatives was developed to respond to identified issues. Written comments received through public and agency scoping were analyzed for content by the USFS. Issues were summarized and reviewed by an IDT, comprised of various USFS and other agency specialists. The team reviewed the issues and separated them into two types: those that would be focus issues for the development of alternatives and those that would be tracked through the document for analysis of impacts. A summary of issues and a key to track issues is provided in Chapter 1. Focus issues for developing the range of alternatives were identified as follows:

- Water Quality - Acid Rock Drainage (ARD) Potential
- Waste Rock Dump Design for Stability
- Reclamation Potential - Revegetation
- Mine Economics - Economic Viability

Post-mining land use objectives developed by the USFS were also used to guide alternative development. These site-specific objectives are based on management direction and standards and guidelines presented in the LRMP. The objectives were used to guide development and evaluate effects of the proposed Project and the alternatives. Post-mine land use would approximate overall conditions in the Project area prior to mining but would not recreate pre-mining conditions due to changes in topography. Not all of the objectives can be met concurrently on every piece of ground in the Project area. Some objectives are mutually exclusive, but overall the post-mining land use would be a composite of uses that meets the objectives presented below.

1. Forage/Livestock Use. The objective is to provide forage for seasonal livestock grazing on suitable reclaimed acres. Suitability is determined by plant communities, vegetative productivity, topography, access and distance to water.

2. Wildlife. The objective is to provide for a diverse vegetative cover that would retain the soil resource and afford wildlife habitat by utilizing a seed mix that contains native species.

3. Recreation. The objective is to provide for the traditional outdoor recreation activities.

4. Access. The objective is to re-establish the pre-mining public access within the Project area.

5. Visuals. The objective is to provide a natural landscape based on the maximum modification VQO for the area.

6. Minerals. The objective is to provide for responsible exploration and development of mineral resources.

7. Watershed. The reclaimed area would still function as a watershed. The goal is to provide a stable post-mining watershed which can best be accomplished by implementing the following objectives:

   Best management practices would be used to meet baseline conditions and/or applicable state and federal water quality standards during and after mining activities.

   Appropriate reclamation and revegetation measures and storm water routing and runoff measures would be implemented to minimize sediment loading.

As part of the process of alternative development, several preliminary alternatives were considered and later modified or eliminated from further consideration. The IDT developed an initial set of issues and four preliminary alternatives prior to starting the public scoping process. The intent was to give the public a starting point in their analysis and assessment of this Project. Those issues and alternatives were included in the "Initial Scoping Document for the Jerritt Canyon Mine Expansion" mailed in March 1993. As a result of scoping, the original four preliminary alternatives were modified or deleted. One alternative was dropped but was replaced by two alternatives that addressed additional resource concerns not previously identified. During the IDT meetings, two other alternatives were developed to address the potential for underground mining. Other preliminary alternatives were reviewed and eliminated from detailed study because they did not meet baseline criteria for slope stability or economic feasibility. Section 2.5 of this chapter provides more information on alternatives eliminated from further consideration.

2.3 Existing Operations

To assist the reader in understanding the Jerritt Canyon Mine Expansion, a discussion of the existing operations is presented below and explains the various major components of the mining and ore processing operations. These operations are carried out under POO's approved by the USFS and BLM.

Gold Ore Processing

Ore processing produces gold bullion and tailings (by-products that remain after ore is recovered) which are disposed of in a tailings facility. Ore processing and tailings facilities are authorized by BLM and NDEP as closed circuits which do not result in any surface water discharge of process solutions.

Ore excavated from the Jerritt Canyon mine is hauled to the existing mill and processed to recover gold (See Map 1.2). Ore processing consists of several consecutive steps to extract the gold. Processing at the Jerritt Canyon mill consists of crushing, chlorination, roasting, grinding and gold recovery. In general, the process is a typical gold recovery system that uses dilute cyanide to free gold from ore and carbon to recover the gold. The majority of the ore is processed in the mill, using chlorination or roasting techniques, but a small amount of the ore is processed by heap leaching. Current milling operations are

conducted pursuant to the April 1980 ROD for the "Jerritt Canyon Project Final Environmental Impact Statement" and subsequent amendments to the original POO.

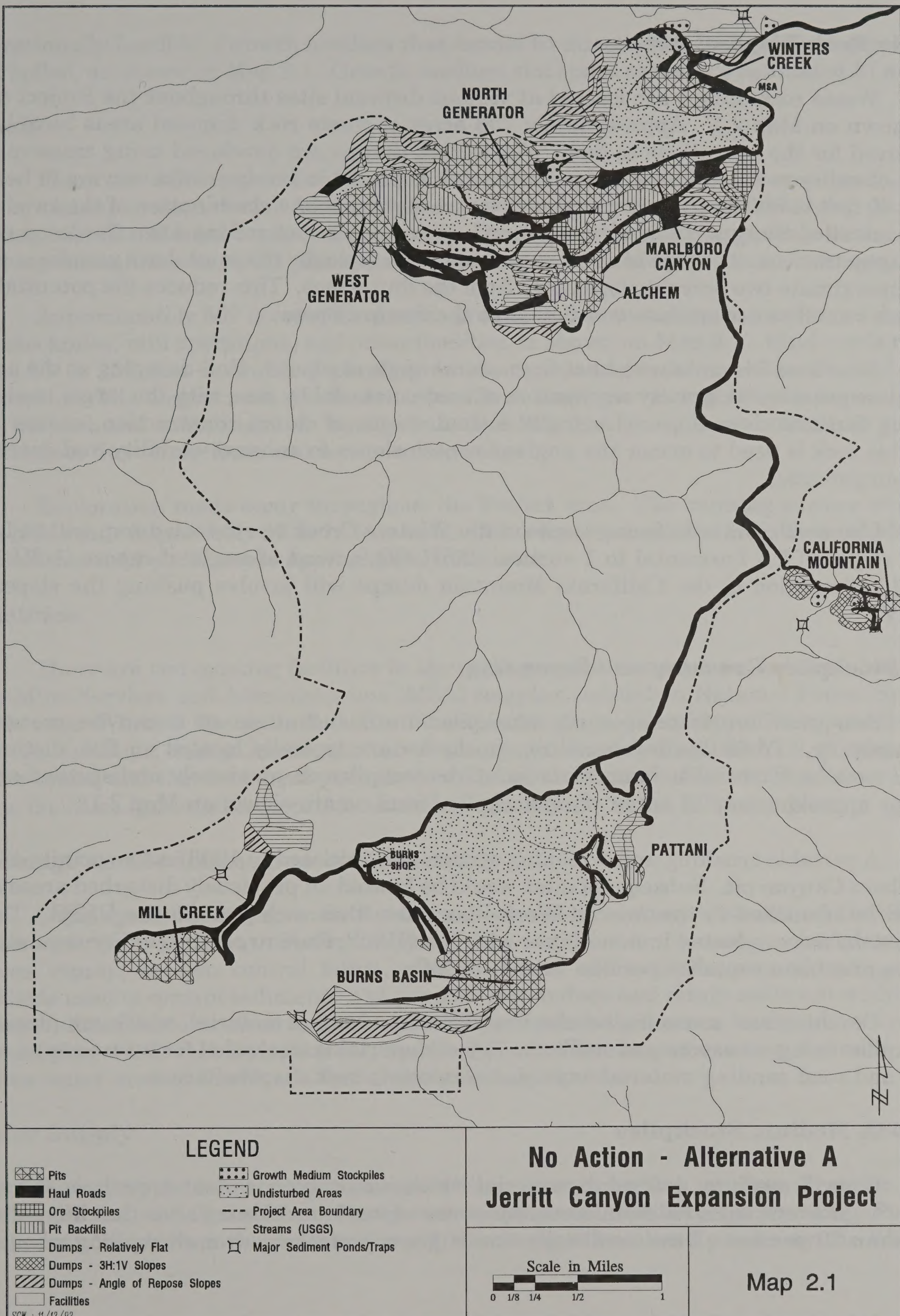
Tailings facilities include an impoundment area (tailings pond), evaporation pond, surge pond and a tailings pipeline to move tailings from the mill to the impoundment. The tailings consist of approximately 30 to 50 percent finely ground rock and between 65 to 70 percent liquid. Tailings from existing operations are currently piped to the original tailings facility until a new tailings facility is completed. The new tailings facility was approved by the BLM on June 29, 1993, after completion of an EA, which is incorporated by reference in this FEIS. The EA analyzed the disturbance necessary to achieve the proposed ultimate capacity of 30 million tons in the new tailings impoundment. The Decision Record for the EA approved the proposed action, indicated that there would be no significant impacts, and required monitoring wells downstream of the new tailings facilities to assure maintenance of zero discharge. The Decision Record only approved the facilities for the 10 million ton capacity required by existing mining operations. This EIS evaluates the proposed mining operations that would require the additional 20 million ton capacity. Authorization for the additional capacity would be made, as appropriate by the BLM after approval of the proposed expansion.

Pits

Although eight mine pits have been established since mining was initiated in the Jerritt Canyon area, existing operations consist of five pits: Alchem, Mill Creek, Burns Basin, Winters Creek and California Mountain (See Map 2.1). All other pit operations have ceased. Pit operations have disturbed approximately 720 acres of which 139 acres have been partially backfilled. Dewatering has not been necessary in any past or existing pit operations.

Pit operations are conducted 24 hours a day on a year-round basis. Ore and waste rock are drilled and blasted in benches to facilitate loading and hauling. Due to the steep pre-mining topography, a pit totally surrounded by highwalls and benches is rarely created. Benches typically range from 20 to 40 feet in height and up to several hundred feet in width. Horizontal drilling and blasting, typically referred to as slabbing, is also authorized in select portions of the pits to increase ore recovery. Underground mining tests have been conducted in the West Generator and North Generator pits to maximize ore recovery and evaluate economic and technical feasibility of underground mining.

Blasted ore and waste rock are loaded into end-dump haul trucks using hydraulic shovels or front-end loaders. The material is then transported in haul trucks with capacities ranging from 85 to 190 tons. Ore is transported either to stockpiles or directly to the mill for processing. Waste rock is transported to waste rock disposal areas or used to construct haul roads.


WINTERS CREEK
MSA
NORTH GENERATOR
MARLBORO CANYON
WEST GENERATOR
ALCHEM
CALIFORNIA MOUNTAIN
BURNS SHOP
PATTANI
MILL CREEK
BURNS BASIN
LEGEND
Pits
Haul Roads
Ore Stockpiles
Pit Backfills
Dumps - Relatively Flat
Dumps - 3H:1V Slopes
Dumps - Angle of Repose Slopes
Facilities
Growth Medium Stockpiles
Undisturbed Areas
Project Area Boundary
Streams (USGS)
Major Sediment Ponds/Traps
SCW : 11/13/93
No Action - Alternative A
Jerritt Canyon Expansion Project
Scale in Miles
0 1/8 1/4 1/2 1
Map 2.1

Waste Rock Disposal Areas

Waste rock dumps are located at various disposal sites throughout the Project area as shown on Map 2.1. Approximately 708 acres of waste rock disposal areas have been approved for the operations to date. Waste rock dumps are developed using cross-valley, head-of-valley or side-hill methods. Waste rock is placed in levels or lifts varying in height from 40 feet to 600 feet. Rock catchment trenches, berms or a combination of the two have been installed along portions of some dump toes to contain rock rolling down the dump faces during operations. The tops of waste rock dumps are typically flat, undulating surfaces with an approximate two percent slope away from the dump face. This reduces the potential for surface runoff to accumulate and flow over the dump slopes.

Waste rock is end-dumped at the natural angle of repose. End-dumping at the angle of repose provides for gravity segregation of waste material by size, with the larger boulders rolling farthest downslope. During the final stages of dump construction, coarse and durable rock is used to armor the angle of repose slopes to enhance stability and decrease erosion potential.

The north and east facing slopes of the Winters Creek waste rock dump will be built with slopes of 2.5 horizontal to 1 vertical (2.5H:1V) instead of angle of repose (1.3H:1V). Final reclamation of the California Mountain dumps will involve pushing the slopes to 3H:1V.

Ore Stockpiles/Crushing and Screening

Sub-grade ore is temporarily stockpiled until such time as it can be processed economically. To facilitate rehandling, stockpiles are typically located on flat, disturbed areas such as waste rock dump surfaces. Ore stockpiles on previously undisturbed areas occupy approximately 31 acres. Ore stockpile locations are shown on Map 2.1.

A portable crushing and screening system was initiated in 1993 in the vicinity of the Marlboro Canyon pit. Subsequent sites would be located on previously disturbed areas and would be identified in the Annual Work Plan submitted each year to the USFS. These operations are conducted in accordance with the NDEP, Bureau of Air Quality regulations and applicable air quality permits issued to IMC.

Crushing and screening results in mill feed and reject material, which are placed in stockpiles using conveyors and stackers. Reject material is stockpiled for future use as road base and road sanding material or is placed in waste rock disposal areas.

Growth Medium Stockpiles

Growth medium, defined as material which is suitable for plant growth, is salvaged from the pits or is removed from accessible areas of waste rock dump sites that have slopes less than 30 percent. Direct redistribution is given preference over stockpiling whenever

operationally feasible. Growth medium that cannot be directly redistributed is temporarily stockpiled, as shown on Map 2.1. Growth medium stockpiles occupy an estimated 87 acres.

Roads

There are three types of roads within the mine operations area: access roads, haul roads, and exploration roads. Access roads are used by heavy equipment to develop pits and dumps, install sediment control structures, and perform other site preparation work. Most of these roads are eventually eliminated by mining or covered by waste rock dumps.

Approximately 597 acres of haul roads provide access to mine pits, waste rock dumps, ore stockpiles, mill operations, and other facilities as shown on Map 2.1. Haul roads range from 50 to 250 feet in width depending on the type and frequency of traffic and road alignment. The largest road widths are typically at sharp curves and intersections. Roads are bermed and maintained to ensure safe and efficient hauling operations, to reduce particulate dust emissions, and to control drainage.

Exploration roads occur throughout the Project area. The running surface of these one-lane roads is generally 12 to 16 feet wide. Disturbance associated with these roads and exploration drill pads covers approximately 954 acres.

Facilities

There are two existing facilities in the mining operations area as shown on Map 2.1. The Mine Services and Administration (MSA) complex, located on National Forest System lands near Winters Creek, includes: a maintenance shop; tire shop; offices; warehouse; storage buildings; change house; explosives storage area; ready lines; fuel, oil, propane and water tanks; and the associated underground and above-ground utilities. The Burns Basin mine facilities are located on private land and are similar to the MSA complex.

Drainage and Sediment Control Structures

Drainage and sediment control structures consist of a variety of structures that divert water and retain sediment. Sedimentation ponds, sediment traps, sumps, checkdams, silt fences, riprap, erosion control fabric, and vegetative sediment filters are some of the methods used to control sediment. The purpose is to reduce and retain sediment within the areas of disturbance or close to its source. Water control ditches are used to divert runoff around pits, waste rock dumps areas, and haul roads. The largest existing diversion ditch routes water around the Burns Basin waste rock dump area.

Water Supply

Water supply for existing mine operations comes from two sources: 1) water wells at the mill site, and 2) the Burns Basin water supply well, located adjacent to the Pattani haul road. Water from the wells at the mill site is piped to a lined pond near the Winters

Creek Mine area and the MSA area. Water from the Burns Basin well is currently stored in 10,000 and 20,000 gallon tanks.

Hazardous Materials: Fuel and Explosive Storage and Handling

IMC's mining operations do not use or produce any materials classified as hazardous other than petroleum products, antifreeze, or explosive products. Petroleum products and antifreeze are stored in approved locations, containers, and structures at the MSA complex and Burns Basin shop. Current operations utilize approximately 450,000 gallons per month of diesel fuel. IMC adheres to a Spill Prevention Control and Countermeasure Plan (SPCC) for the Jerritt Canyon Project which includes the Burns Basin operations. The existing storage areas are located and constructed so as to contain any accidental spills. Petroleum storage tanks have a containment basin large enough to hold the contents of the tank in case of a spill. Explosives are stored, transported, and used in compliance with regulations established by state and federal regulatory agencies.

Reclamation

Reclamation activities for existing operations are detailed in the POOs approved for each mining area. Reclamation generally consists of armoring angle of repose waste rock dump slopes with coarse and durable rock; partially or fully recontouring roads; placing waste rock into mined out areas of pits as partial backfill; providing drainage controls; removing structures no longer needed after completion of operations; revegetating by applying growth medium and reseeding various designated areas; and providing public safety measures, such as safety berms. Approximately 194 acres of disturbance designated for final reclamation have been reseeded.

2.4 Alternatives Considered for Detailed Study

This section describes alternatives to the Proposed Action including the No Action Alternative. Consideration of the No Action Alternative is required by NEPA. Five other alternatives were developed to respond to various issues as described in the section titled "Formulation of Alternatives." The alternatives are labeled from A to G throughout this FEIS.

To simplify and to eliminate repetitive discussions, these alternatives are described in terms of their differences from the proposed action, Alternative B. Table 2.1 summarizes disturbance by each alternative. Table 2.2 displays areas to be reclaimed and revegetated.

All alternatives considered for detailed study include the reasonably foreseeable future mining activities. These potential future activities are included in the disturbance area calculations shown on Table 2.1. The reasonably foreseeable future activities were projected as the potential additional area of disturbance that might occur if gold prices were to increase over current levels. If gold prices stay at current levels into the reasonably foreseeable future, the actual area of disturbance would be smaller than that displayed on

Table 2.1
Summary
Disturbance by Alternative (in Acres)

Disturbance Type	Alternative						
	A (existing)	B[1]	C	D	E	F	G
Pit	581	1,332	1,332[2]	1,332	1,332	803	1,332
Partial Pit Backfill	139	0	50	13	13	0	0
Dumps Total	708	1,308	1,388	1,413	1,298	730	1,323
Angle-of-Repose	234	276	223	22	78	178	278
2:1 Slopes	0	0	26	0	26	0	0
3:1 Slopes	27	0	73	503	277	0	0
Flat	447	1,032	1,065	889	916	552	1,045
Haul Roads	597	184	189	249	173	275	216
Ore Stockpiles	31	12	12	12	12	13	12
Sediment Ponds/Traps	4	11	10	10	11	10	11
Growth Media	87	119	118	113	113	52	119
Other	36	0	0	0	0	158	0
Total Disturbance Acres	**3,137[3]**	**2,966**	**3,099**	**3,142**	**2,952**	**2,041**	**3,013**
Area of Overlap with Existing Disturbance	N/A	(407)	(437)	(398)	(395)	(264)	(408)
Net Additional Disturbance	N/A	2,559	2,662	2,744	2,557	1,777	2,605
Total Net Cumulative Disturbance	**3,137[3]**	**5,696**	**5,799**	**5,881**	**5,694**	**4,914**	**5,742**

Source: GIS Computer-generated Statistics 1993.

Note: [1] Alternatives B through G show new disturbance.
[2] Includes 77 acres of partial backfill into EIS pits.
[3] Includes 954 acres of exploration and USFS roads.

Table 2.1 and on the maps of Alternatives B-G (Maps 2.2, 2.5, 2.6, 2.7, 2.8, and 2.9). Throughout this EIS, analysis of each alternative is actually an analysis of the reasonably foreseeable future development that may occur under each alternative. By conducting the analysis using the larger area, additional environmental analysis may not be required for future related actions, unless the various activities were not covered in the EIS or exceed the acres analyzed.

Table 2.2 Proposed Disturbance and Reclamation by Alternative (Acres)							
	Alternative						
	A	B	C	D	E	F	G
Disturbance Area[1]							
Existing[7]	2,183	407	437	398	395	264	408
New	N/A	2,559	2,662	2,744	2,557	1,777	2,605
Total Proposed Disturbance[2]	2,183	2,966	3,099	3,142	2,952	2,041	3,013
Reclamation Area							
Areas to be Revegetated[3]	1,229	1,358	1,468	1,775	1,503	1,060	1,403
Other Reclamation[4]	234	276	249	22	104	178	278
Total Reclamation	1,463	1,634	1,717	1,797	1,607	1,238	1,681
Pits[5]	581	1,332	1,332	1,332	1,332	803	1,332
Backfill[6] of Existing Pits	139	0	50	13	13	0	0
Total[8]	**2,183**	**2,966**	**3,099**	**3,142**	**2,952**	**2,041**	**3,013**

Note:
[1] Null inclusions and undisturbed areas not included.
[2] Does not include exploration or USFS roads (954 acres)
[3] Includes 3:1 dump slopes, flat dump tops, haul roads, ore stockpiles, sediment ponds, growth medium stockpiles, and other disturbances as displayed in Table 2.1.
[4] Includes angle of repose dump slopes and 2:1 dump slopes as displayed in Table 2.1.
[5] Portions of proposed pits may be partially backfilled and revegetated under all alternatives, but these acreages cannot be calculated until the pits are developed.
[6] Portions of existing pits may be backfilled under all alternatives. Conceptual potential backfill acres are displayed for Alternatives C, D, and E.
[7] Areas of overlap with existing disturbance.
[8] Includes areas to be revegetated, areas of other reclamation, proposed pits and areas of existing pit backfill.

All alternatives would be consistent with the LRMP, with the exception of Alternative A, which would conflict with IMC's right to mine under the General Mining Law of 1872. All action alternatives would be within the legal jurisdiction of the USFS.

Alternative A - No Action

Under the No Action Alternative displayed on Map 2.1, the USFS would not authorize the proposed action or any action alternative. Current operations, already approved as described above under "Existing Operations," would continue. However, the General Mining

Law of 1872 gives IMC certain rights to conduct mining operations on public lands. The No Action Alternative is required by NEPA and serves as a baseline for evaluation of the action alternatives.

Existing operations at the Jerritt Canyon Project are estimated to continue at current levels until 1994, at which point mining operations would begin to decline and cease sometime before or during 1996. Employment, estimated at 600 persons in 1993, would decline accordingly.

Alternative B - Proposed Action

The proposed action for the Jerritt Canyon Mine Expansion is the development, operation and reclamation of the Saval, Steer, and New Deep mine areas and expansion of the existing Burns Basin mine area as shown on Map 2.2. Saval and Steer are new mine areas that were originally identified in the 1980 Jerritt Canyon Final EIS as areas with future mining potential. The New Deep mine area is an extension of the West Generator pit, which was started in 1986 and completed in 1993. The proposed action includes the expansion of the Burns Basin mining operations. Mining in this pit began in 1988 and continues as an existing operation. Proposed mining operations are expected to result in production of gold from 20 million tons of ore.

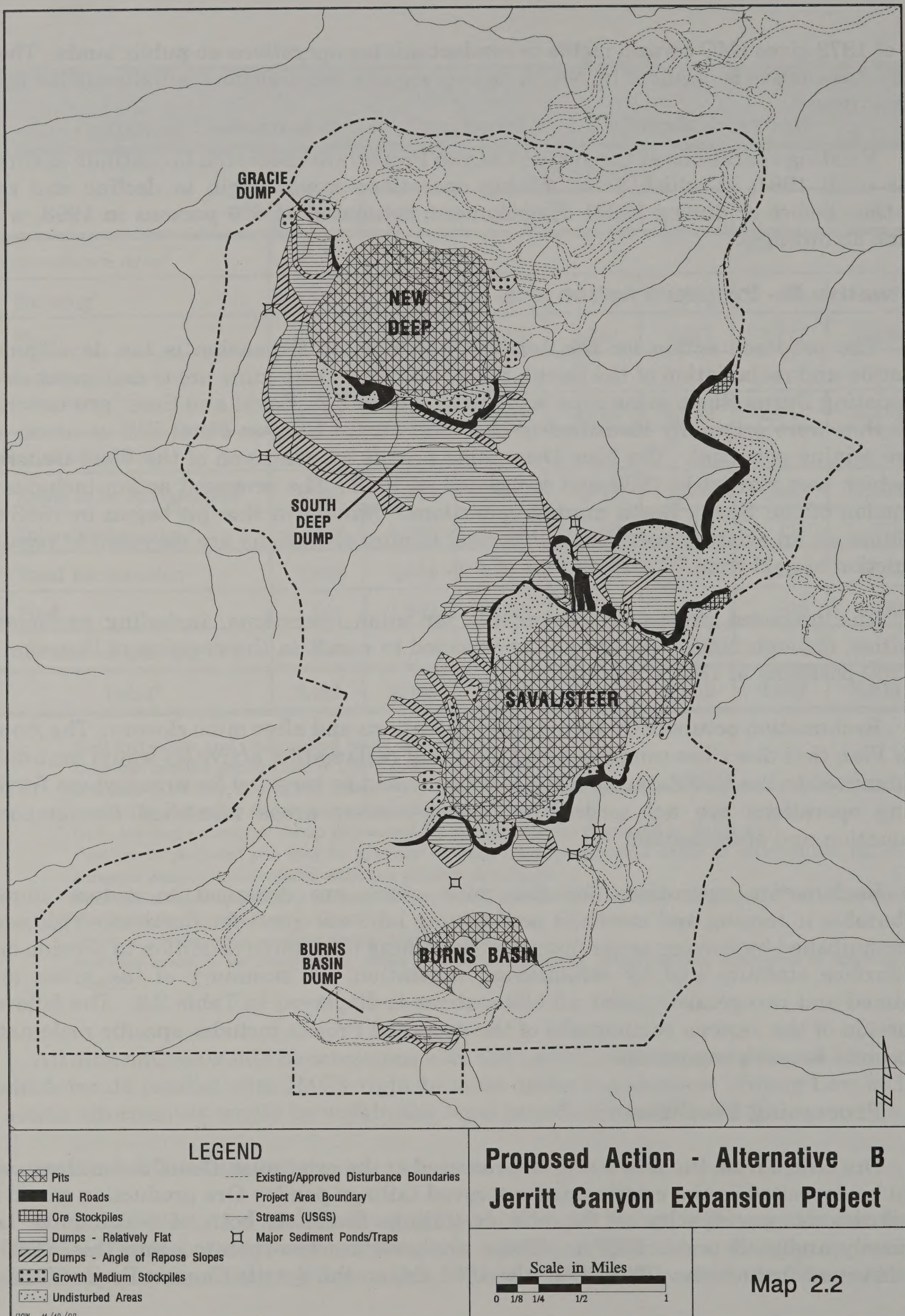
The proposed project would provide for mine operations, including reclamation activities, through 2005. The Project is expected to result in the creation of between 150 and 200 positions at IMC's operations.

Reclamation occurs both during mine operations and after mine closure. The Annual Work Plan that describes completed and projected reclamation activities would continue to be submitted to the USFS. Annual reclamation would be targeted for areas where further mining operations are not anticipated and for other areas identified for temporary reclamation and stabilization.

Reclamation operations for the mine areas are designed to reduce impacts attributable to mining and meet the post-mining land use goals for the area. This would be accomplished by leaving areas disturbed by mining in a stable condition to provide mass and surface stability and by establishing vegetation. A summary of the areas to be reclaimed and revegetated under all alternatives is displayed in Table 2.2. The following discussion of the various components of the proposed Project includes specific reclamation procedures for each component.

Processing Facilities

Ore mined from the pits would be processed at the existing mill and the milling waste would be deposited in the existing and approved tailings ponds. Ore production would not exceed the design capacity of the mill or tailings facilities, both of which have been previously analyzed under NEPA. Those analyses are incorporated into this FEIS by reference and include the 1980 FEIS, the 1991 EA on the Jerritt Canyon Project Tailings


GRACIE DUMP
NEW DEEP
SOUTH DEEP DUMP
SAVAL/STEER
BURNS BASIN
BURNS BASIN DUMP
LEGEND
Pits
Haul Roads
Ore Stockpiles
Dumps - Relatively Flat
Dumps - Angle of Repose Slopes
Growth Medium Stockpiles
Undisturbed Areas
Existing/Approved Disturbance Boundaries
Project Area Boundary
Streams (USGS)
Major Sediment Ponds/Traps
SCW : 11/13/93
Proposed Action - Alternative B
Jerritt Canyon Expansion Project
Scale in Miles
0 1/8 1/4 1/2 1
Map 2.2

Dam Raises, and the 1993 EA for the new tailings pond. The existing tailings pond has enough capacity to accept tailings until about September 1995. There would be no difference in the type of tailings deposited, construction or operation of the facility or disturbance associated with the facility, from that analyzed in the EA for the new tailings pond. It is anticipated that the proposed action being analyzed in this EIS would result in an approximate additional 20 million tons of mill waste to the tailings impoundment. The EA for the new tailings pond included analysis of a 30 million ton capacity, which provides for 20 million tons of additional capacity over that needed for existing operations.

The BLM would review and approve any additional raises to the tailings impoundment that would be required as a result of the expanded mining operations examined in this FEIS. It is anticipated that four raises with an approximate capacity of five million tons for each raise would be required for the estimated 20 million tons of additional mill waste resulting from the proposed expanded mining operation.

Pits

The Project would operate on a 24-hour-a-day, year-round basis. Conventional open pit mining methods would be the primary means of developing the pits. Total area associated with pit development would be about 1,332 acres. This includes 308 acres of previously disturbed areas. Anticipated pit shapes are displayed on Map 2.2. Final pit shapes would be determined by the results of development drilling around the pits as they are being developed and from results of blast hole ore sampling. Development drilling would be allowed inside the proposed disturbance areas considered in this FEIS. These drilling operations would be conducted in a manner consistent with existing exploration drilling requirements.

Pit development would be similar to the existing operations. Highwall and bench slopes would be dependent upon the geologic conditions encountered during mining, but are expected to range from approximately 30 to 57 degrees. Benches would typically range from 20 to 100 feet in height and up to several hundred feet in width. Based upon current drilling information and mine plans, the distance from the top of the highwall to the bottom of the pits is expected to be 820 feet for the Saval pit, 600 feet for the Steer pit, 1,180 feet for the New Deep pit, and 340 feet for the Burns Basin pit.

During the last year of mining, the New Deep pit would extend below the groundwater table that is estimated to occur at an elevation of approximately 6,100 feet in the vicinity of this mine area. The area of the pit below an elevation of 6,100 feet is about 19 acres in size and decreases with depth. Pit inflow rates below the water table are expected to be on the order of 100 to 300 gallons per minute (HCI 1993). The Saval, Steer, and Burns Basin pit bottoms would be above the water table and only minor inflows from perched groundwater and precipitation are anticipated. Water that collects in the pits during mining would be routed to sumps where it would evaporate or infiltrate the pit floor. If sufficient quantities of water are available, it would be stored in sumps, ponds, or tanks and used for dust suppression or in other facets of the mining operations. The availability of water in the New Deep pit would reduce the amount of fresh water that is currently

pumped over six miles from wells on the east side of the Independence Mountains to a storage pond near the existing mine areas. Active dewatering of the pit area prior to mining using wells and pumps is currently not anticipated. If active dewatering were necessary, the water would be pumped to storage ponds or tanks and utilized for dust suppression, exploration drilling, and washing heavy equipment or other uses at the existing and proposed mine facilities. In the event there was excess water beyond that required for the mining operations, IMC would obtain the required permits for surface discharge or underground injection.

Horizontal drilling and blasting, referred to as slabbing, may also be utilized within select portions of the pits to maximize ore recovery. No increase in surface disturbance is expected to result from this ore recovery technique. Slabbing could eliminate all or portions of the benches developed during surface mining, but the overall highwall angles would still be in the range of 30 degrees to 57 degrees.

Underground mining methods may be utilized within the pits developed in the Project area during or after open pit mining to increase ore recovery. Room and pillar, sublevel stoping and cut/fill underground mining techniques would be the primary means of recovering ore. No new surface disturbance would occur, because the waste rock would be placed in approved dumps or in partial pit backfill areas.

Pit appearance would not normally be altered by reclamation efforts, unless partial backfilling with waste rock is determined to be operationally and economically feasible. Although pits can be exempted from reclamation by NDEP pursuant to its regulations, fine-textured waste rock or growth medium may be applied to portions of the pit bottoms, depending upon availability of these materials. The material would be distributed to depths ranging from eight inches to three feet. The objective of pit revegetation efforts would be to establish a protective ground cover or aspen seedlings in appropriate portions of the pit bottoms. Trees on adjacent sites are potential sources of aspen for pit bottom revegetation. Other woody plant species may also be utilized to develop wildlife habitat within the pits. A mixture of grasses, forbs, and shrubs would be seeded on accessible benches and slopes that are less than 30 percent.

Waste Rock Disposal Areas

Approximately 1.08 billion tons of waste rock would be deposited either in waste rock dumps or in partial pit backfill areas. Partial pit backfill of proposed and existing pits would be conducted where economically and operationally feasible.

Waste rock dumps would be developed as cross-valley, head-of-valley, or side-hill type dumps in single or multiple levels with angle of repose slopes. The majority of the dumps would be built as valley-fills. Proposed dumps would include expansion of the Gracie dump to the west of the West Generator pit and the Burns Basin dump. It is estimated that 1,308 acres of disturbance would result from the waste rock dumps proposed in Alternative B and displayed on Map 2.2. Waste rock from proposed operations could also be disposed of in

other existing, approved waste rock dumps. Specific dump plans would be included in the final POO and approved by the USFS.

The proposed configuration of the Saval and Steer pits would allow the majority of the associated waste rock dumps to be developed in a series of lifts progressing up the natural drainages, as shown on Map 2.2. Two head-of-valley dumps are proposed in the Burns Basin watershed, south of the Saval and Steer pits.

The waste rock from the upper portions of the New Deep pit would be transported to the existing Gracie dump. Waste rock would also be transported out of the southeastern end of the pit and deposited in the South Deep dump. During the later stages of orebody development, the majority of the waste rock would be transported to the South Deep dump. The South Deep dump would be constructed in a series of lifts on the upstream side progressing in height to the main flat surface of the South Deep dump. Angle of repose slopes would occur on both the upstream and downstream sides of the South Deep cross-valley dump configuration.

The proposed waste rock dump for expansion of the Burns Basin pit would be an extension of the southern portion of the existing dump. Partial backfilling of the Burns Basin pit may also be conducted.

The principal waste rock dump stability objective would be to provide structurally competent slopes to withstand anticipated geologic and climatic conditions without failure that would threaten public safety and the environment. Low-strength materials, typically silts and clays, would be placed in non-critical areas within the dumps.

Waste rock dumps would cover areas where there are aspen, willow and brush. Removal of trees, brush, or slash from the waste rock dump areas would not be operationally feasible over most of the area due to the steep slopes. Aspen trees in accessible portions of the disturbance areas would be made available for firewood when this would not pose a safety hazard or interfere with mining operations. If slash removal is determined to be necessary, then the slash would either be burned in accordance with applicable USFS guidelines or piled in non-critical areas. An undetermined number of live aspen would be salvaged for transplanting in other areas. Aspen outside of the planned disturbance areas would be avoided.

Dumps were designed to limit disturbance of drainage bottoms, springs and wetlands. These areas could not be avoided at all locations due to topographic constraints, economics, and dump stability considerations. Accessible springs or seeps discovered during dump construction would be isolated by building drainage systems. The need for and design of drainage systems would be determined in consultation with and subject to approval by the USFS. The dumps would cover portions of stream channels and therefore require under-dump drainage systems. These would consist of large rocks placed by gravity sorting of materials during dumping. Materials that are predominantly fine textured would be dumped outside the main channels during the initial stages of building the under-dump drainage systems. The under-dump drain for the New Deep dump would be designed to

pass the run-off from the 100 year precipitation event. The drain size and configuration would be determined based on the location of the dump in the drainage, the expected flows the drain will be required to pass, and potential for impoundment of water.

Rock catchment trenches, berms, or a combination of the two would be installed along portions of the dump toes to protect sediment control structures and undisturbed areas from waste rock that may roll down the dump faces during operations.

Plans for development of the waste rock dumps would be included in the final POO. Any remaining dump condemnation drilling would be allowed inside the disturbance areas considered in this FEIS. These drilling operations would be conducted in a manner consistent with existing operating requirements for exploration drilling.

Reclamation of all angle of repose dump slopes would be accomplished by armoring these areas with coarse and durable rock. Fine-textured waste rock and/or growth medium would be used to cover portions of the upper dump slopes. Sediment from the upper slopes would be captured on the flat surfaces of the lower dumps. These slopes would be seeded with species of grasses, forbs, and shrubs.

Compacted waste rock dump tops would be scarified either before or after growth medium application. Large depressions on the surface of the dumps would be regraded and/or filled to prevent water impoundment after reclamation. The undulating surface of the dumps would be sloped to direct runoff away from the main dump face and toward the contact with the natural topography. Undulating dump surfaces would be seeded with a mixture of grasses, forbs, and shrubs. Aspen and other woody plant species would be planted in locations on the dump surfaces that are expected to encourage survival.

Ore Stockpiles/Crushing and Screening

Some ore from the proposed pits would be stockpiled at various locations as shown on Map 2.2. With the exception of approximately 12 acres adjacent to the Burns Basin haul road, there would be no new additional disturbance as the stockpiles would be located on previously disturbed areas.

Crushing and screening of ore may be conducted at various locations using the portable equipment described in the "Ore Stockpiles/Crushing and Screening" section for existing mine operations. No new surface disturbance would result from these operations since IMC plans to locate them on approved disturbance areas. These operations would be conducted in accordance with NDEP regulations and applicable air quality permits. Haul trucks or conveyors would be used to transport crushed ore to stockpiles. Reject material would be hauled to waste rock dumps or stockpiled for use as road surfacing or sanding materials.

The number, type, and size of ore stockpiles that would remain after operations are completed depends on mine economics and developments in mine processing technology. Any ore stockpiles that remain after mining ceases would be reclaimed in the same manner

as described for waste rock dumps. Relatively flat surfaces of ore stockpiles would be sloped away from the main angle of repose slopes. Growth medium would be applied to these flat surfaces where fine textured materials do not make up the final surface.

Growth Medium Removal and Stockpiling

Growth medium would generally be recovered from those portions of the pits with slopes less than 30 percent. Recovery of growth medium during mining of the pit would occur on slopes steeper than 30 percent when operationally feasible.

Direct redistribution would be given preference over stockpiling of growth medium. Growth medium that could not be directly redistributed would be stockpiled. Mixing of waste rock materials with growth medium would be reduced by locating stockpiles away from centers of activity. Anticipated locations for the growth medium stockpiles are shown on Map 2.2. Growth medium stockpiles would cover about 119 acres, including stockpiles that are located on waste rock dumps.

Growth medium stockpiles would be stabilized by a variety of measures. The type of stabilization measure used would be dependent upon the anticipated life of the stockpiles. The growth medium stockpiles would initially be developed with angle of repose slopes. Erosion controls such as berms, hay bales, or silt fence may be installed alone or in combination to control erosion. Angle of repose slopes on stockpiles that are in place longer than two years would be reduced to 2H:1V. Active stockpiles would not be seeded unless an adequate amount of time would elapse for plants to become established. Long term stockpiles would be seeded with an appropriate seed mixture during the first planting season after stockpiling is completed.

Roads

Haul Roads

Construction of a haul road network within the Project area would be required to develop the Project. New haul roads are anticipated to disturb about 184 acres outside of areas that would eventually become pits or waste rock dumps. Designs and specifications for the roads would be reviewed and approved by the USFS as part of the final POO.

No changes to alignment or dimensions are anticipated for the haul road to the mill outside of the Project area shown on Map 1.2. Issues identified with the location of the haul road in the 1980 Jerritt Canyon Project Gold Mine and Mill FEIS included the proximity of Lahontan cutthroat trout. Use of this road for existing and/or approved operations would be conducted in accordance with maintenance and operational guidelines approved by the USFS to protect Lahontan cutthroat habitat and other resources. These guidelines provide for dust and drainage controls. Extension of the time period for use of the haul road would result in continued closure of the area for livestock grazing and public access.

Haul road re-alignment may be necessary during construction to accommodate unanticipated field, ground, or geologic conditions. The roads displayed on Map 2.2 are the anticipated road alignment corridors.

Final road locations would be determined within an adjustment zone corridor, as identified in the preliminary POO. Final road locations would be dependent upon on-site engineering factors including avoidance of wetlands and areas requiring major road cuts. Should changes to the haul road alignment or dimensions be necessary, the changes would first be field-reviewed with the USFS.

It is currently anticipated that two sections of the existing Burns Basin haul road would be mined out by the Saval and Steer pits. The sections of haul road mined out by the pits would be re-established to maintain access.

Haul roads would be constructed using a combination of various cut and fill methods. Construction would include drainage features such as ditches and/or culverts and safety berms on the outer edge. A berm or trench would be built along the toe of the haul road fill to help protect undisturbed areas from rolling rocks. Seeding of haul road cut and fill slopes and safety berms would be initiated after construction is completed.

The running surface of the haul roads would range from approximately 70 to 250 feet in width, depending on the type and frequency of traffic and road alignment. Straight sections of the haul road running surfaces would typically be between 70 and 100 feet wide. At curves, intersections, and switchbacks, the haul road running surface may range up to 250 feet in width. The running surface would generally have grades between zero and ten percent. Truck run-away ramps would be built as needed in accordance with MSHA regulations.

<u>Access Roads</u>

Development of pits and dumps would require construction of roads 20 to 80 feet wide for access. These roads would be needed for heavy equipment to conduct under-dump drain work, clear trees, remove and stockpile growth medium, and install sediment control structures. These roads would be eliminated by mining, covered by waste rock dumps or reclaimed.

<u>Drainage Control</u>

Haul roads would be constructed and maintained so as to assure adequate drainage and to minimize or where practicable, eliminate damage to soil, water and other resource values. Final haul road location and design, with accompanying plans, profiles and cross sections, would be included in the final POO, and field reviewed and approved by the USFS prior to construction.

The haul road drainage plan would include a means of conveying runoff under the haul road at stream channel crossings. Other drainage controls along the haul roads would

be provided by culverts, french drains, rolling dips, cross drains or other effective measures. The drainage control structures would be designed to effectively convey surface runoff across fill slopes and onto natural surfaces. Drainage control features would be kept clear of debris so that drainage systems function efficiently.

Dust Control

Roads would be maintained to ensure safe and efficient travel. Dust suppressants would be applied to control fugitive emissions. The principal dust suppressants expected to be utilized are water, calcium chloride, and magnesium chloride. To further reduce dust emissions, speed limits have been set at 25 mph for haul trucks and 35 mph for service vehicles.

Reclamation

Except for road sections which may be authorized by the USFS to be left open for resource management or recreational use after mining is completed, mine roads would be closed and reclaimed.

Haul roads within the Saval, Steer and Jerritt Creek drainages would be partially recontoured. Compacted roadbeds would be ripped or scarified before or after recontouring operations are initiated. The principal source of growth medium for haul road reclamation would be the growth medium on road safety berms and fill slopes.

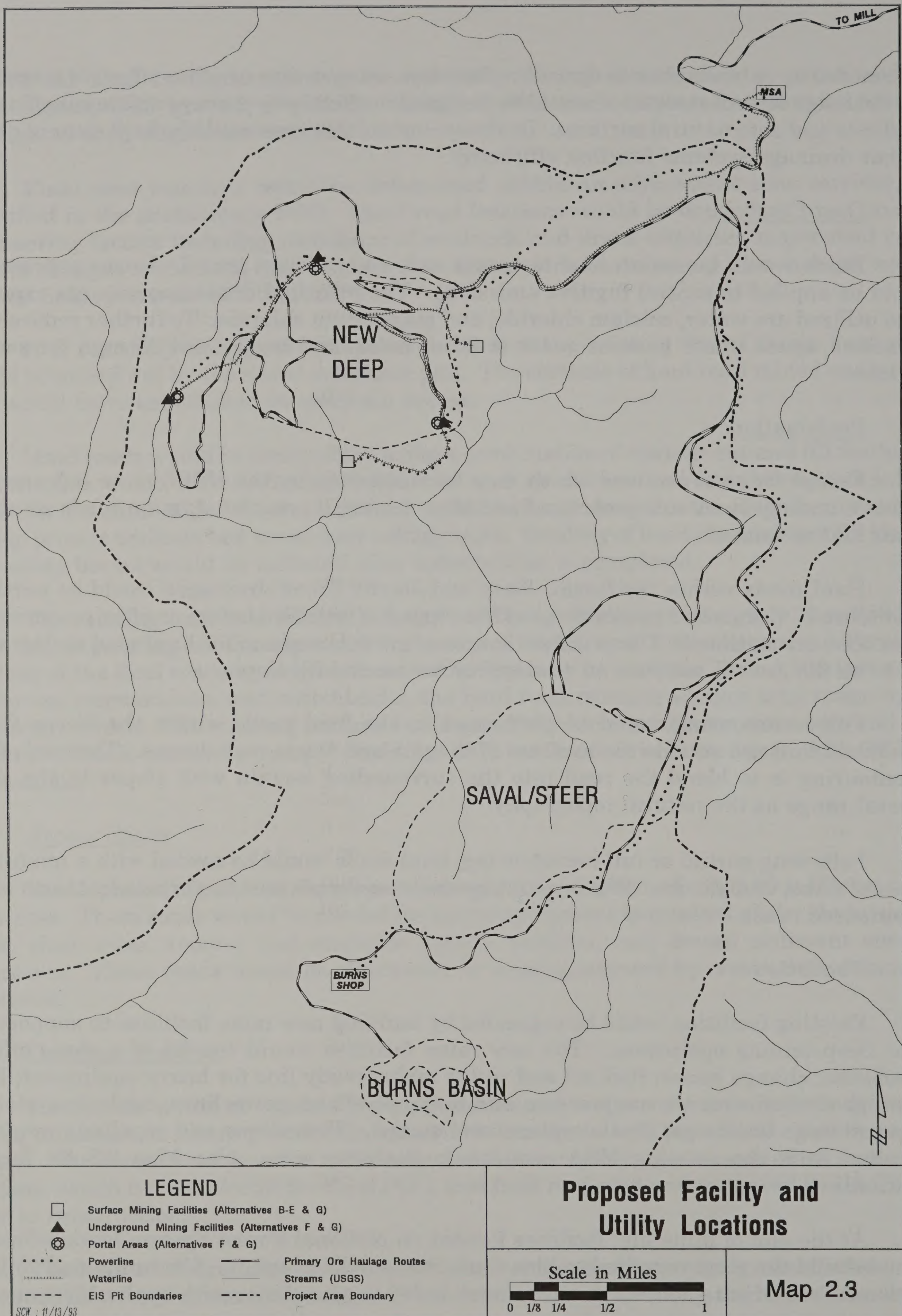
Full recontouring would be performed on the haul roads within the Burns Creek watershed that are outside the confines of the pits and waste rock dumps. The goal of full recontouring is to blend the road into the surrounding terrain with slopes in the same general range as the natural topography.

Following partial or full recontouring, haul roads would be seeded with a mixture of grasses, forbs, and shrubs. Woody plant species may be planted at various locations along recontoured roads.

Facilities

Existing facilities would be expanded by building new mine facilities to support the New Deep mining operations. The new mine facilities would consist of a shop; offices; warehouse; change house; fuel, oil and water tanks; ready line for heavy equipment; light poles, generator sets; air compressors and lines; pipelines; powerlines; explosives storage areas; storage buildings; septic system; and sumps. Powerlines and pipelines would be installed from the existing MSA complex to the mine area. (See Map 2.3 for facility locations).

At the end of mine life, facilities located on National Forest System lands would be removed and the sites regraded to blend into surrounding terrain. Contaminated soils on National Forest System lands would be remediated in accordance with applicable state and


TO MILL
MSA
NEW DEEP
SAVAL/STEER
BURNS SHOP
BURNS BASIN
LEGEND
Surface Mining Facilities (Alternatives B-E & G)
Underground Mining Facilities (Alternatives F & G)
Portal Areas (Alternatives F & G)
Powerline
Waterline
EIS Pit Boundaries
Primary Ore Haulage Routes
Streams (USGS)
Project Area Boundary
SCW : 11/13/93
Proposed Facility and Utility Locations
Scale in Miles
0 1/8 1/4 1/2 1
Map 2.3

federal requirements. Growth medium would be spread on relatively flat areas accessible to heavy equipment. Areas where facilities are removed would be recontoured so that runoff or other short term surface flows would infiltrate the soil and control sedimentation and erosion. The Burns Basin mine facilities, located on private land, may be retained for future use after mining has ceased.

Drainage and Sediment Control Structures

Anticipated locations for major sediment ponds and traps are shown on Map 2.2. The proposed sediment pond in Jerritt Canyon and six sediment traps are expected to result in approximately 11 acres of new disturbance. Final designs and specifications for sediment control structures would be incorporated into the final POO. Final locations of sediment ponds and traps would be field reviewed with USFS representatives prior to construction.

The sediment pond in Jerritt Canyon would be constructed to capture sediment originating from the South Deep dump slopes that face downstream. The design storage capacity would be maintained by continuous dewatering of the impoundment area. A spillway would be constructed to pass peak flows.

Sediment traps would be designed and constructed according to site-specific conditions. Diversion ditches may be constructed within the confines of the disturbance areas of the pits, dumps and/or haul roads to control runoff. Sediment control structures would be seeded with rapidly establishing plants.

After revegetation of disturbed areas, sediment control structures would be no longer needed. The sedimentation pond and sediment traps would be removed unless the USFS decides to retain them as post-mining water sources. Removal of these structures would consist of reestablishing the stream channels by excavating the fine sediment in the impoundment areas to stream level and contouring the material to blend with surrounding terrain. Disturbance created during removal of sediment control structures would be seeded with a mixture of grasses, forbs, and shrubs. Woody plant species would also be planted in these areas because the expected favorable moisture conditions would promote successful establishment.

Water Supply

IMC may develop new wells as a source of water for the mining operations and facilities. Specific locations for new water supply wells have not been identified. Should new water sources be necessary, IMC would obtain the required permits from the Nevada Division of Water Resources (NDWR) and USFS approval, if needed.

Hazardous Waste: Fuel and Explosive Storage and Handling

Petroleum products would be stored in appropriate locations, containers, and structures at the MSA complex, Burns Basin shop, and new mine facilities. Spill prevention would be conducted in accordance with the SPCCP for the Jerritt Canyon project. IMC

would notify the USFS and other appropriate agencies of spills that meet the reportable quantity criteria specified by NDEP and EPA.

Health and Safety

IMC would continue to take precautionary measures for the health and safety of the public and IMC employees. Active mining operations areas would need to be closed for public safety reasons. The existing road closure on USFS Road 875 in Jerritt Canyon would be moved about 1.5 miles downstream from its current location in the western portion of Section 3, T40N, R53E to the middle of Section 5, T40N, R53E. The existing gate on Arana road would be moved less than one quarter mile to the west. The existing and proposed closure locations for these areas are shown on Map 2.4. No other new road closures are anticipated.

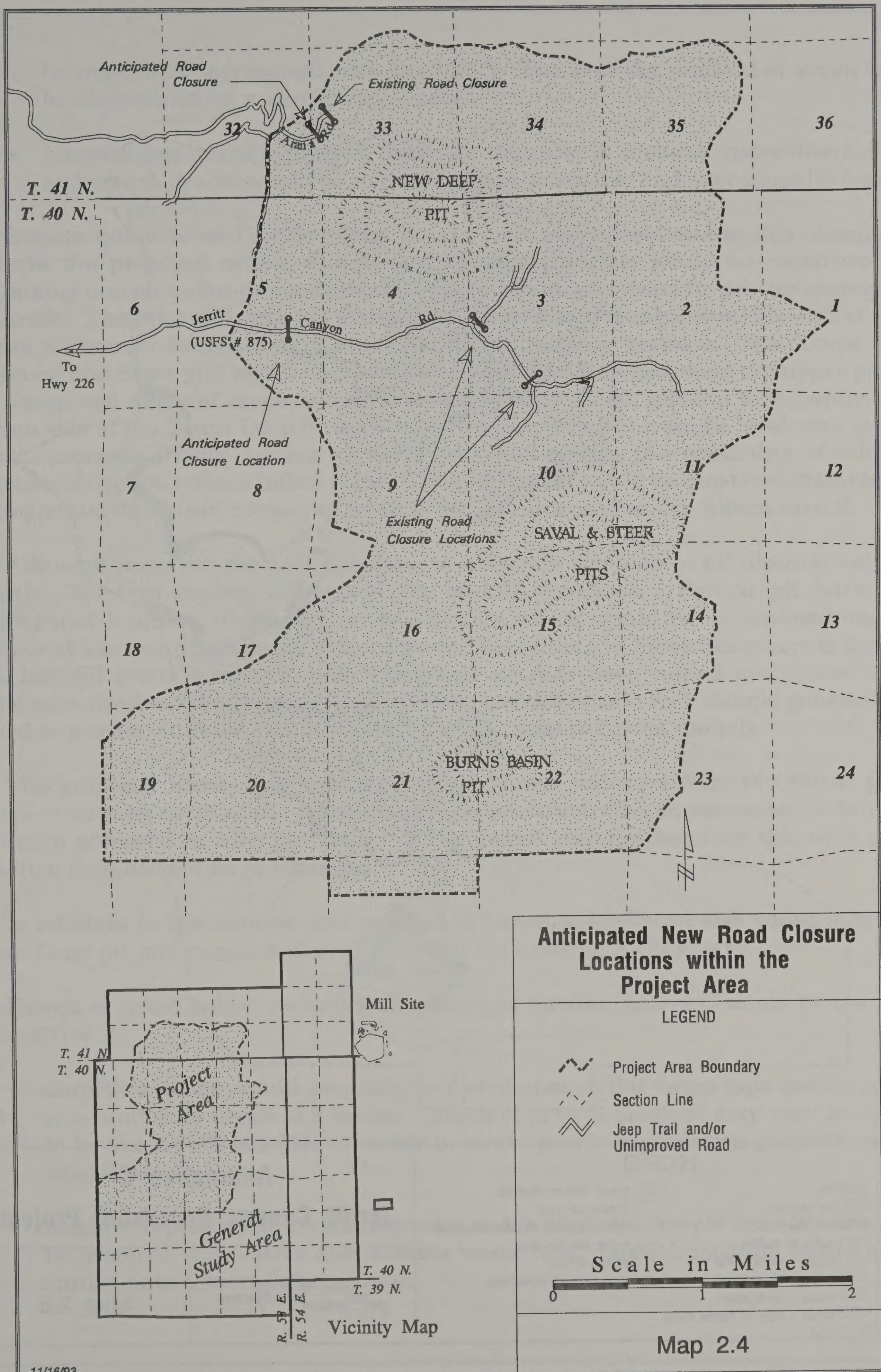
IMC would reduce the exposure of the public to mining related hazards after final mine closure by using one or more of the following methods: 1) restricting access with earthen berms or other effective barriers, 2) removing structures and equipment, 3) plugging drill holes, 4) leaving stable slopes, and 5) closing or sealing underground openings inside pits.

Alternative C

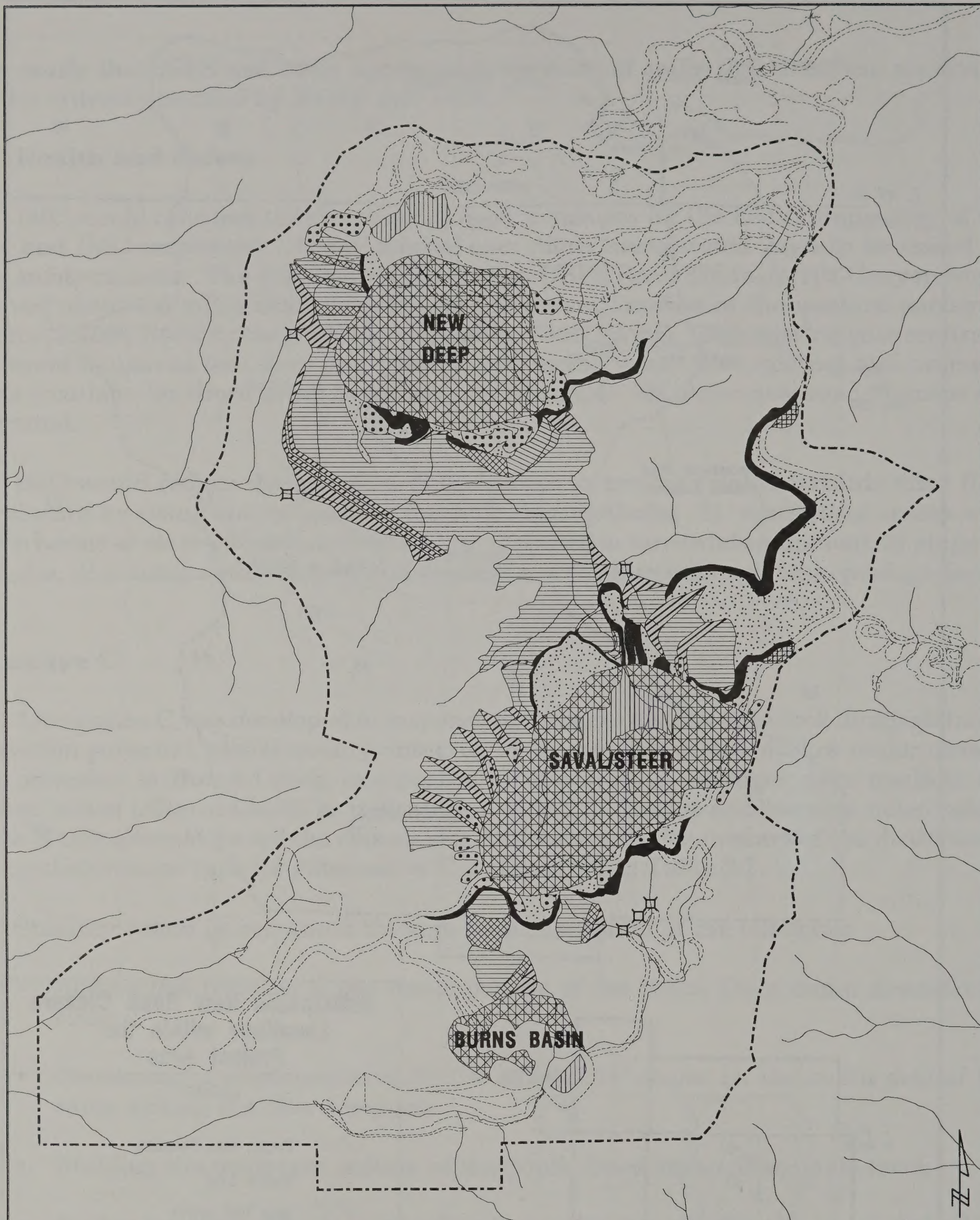
Alternative C was developed in response to concerns about waste rock dump stability, reclamation potential, visual quality, integrity of stream inflow and outflow under dumps, water diversion in Burns Creek, and partial pit backfilling. Changes were made to the proposed action (Alternative B) as indicated on Map 2.5. Except as otherwise noted below, aspects of this alternative are the same as for Alternative B. A summary of the disturbance acres by disturbance type for Alternative C is displayed in Table 2.1.

Stability would be enhanced through implementation of the following:

- Adding two terraces to the upper portion of the South Deep dump downstream slope;
- Developing a combination of 2H:1V and 3H:1V slopes on the south side of the ramp exiting the New Deep pit;
- Building the upstream portion of the South Deep dump as a single level;
- Reshaping upper slopes of the Gracie dump extension (to the west of the New Deep pit) to 3H:1V and adding two terraces;
- Adding 3H:1V slopes to the dumps south of the Saval and Steer pit area.
- Aspen that may affect the performance of the under-dump drain within a 200-foot wide strip centered along the axis of the existing surface drainage channels would



Anticipated Road Closure
Existing Road Closure
Aran a Rd.
NEW DEEP PIT
T. 41 N.
T. 40 N.
Jerritt Canyon Rd.
(USFS # 875)
To Hwy 226
Anticipated Road Closure Location
Existing Road Closure Locations
SAVAL & STEER PITS
BURNS BASIN PIT
32
33
34
35
36
6
5
4
3
2
1
7
8
9
10
11
12
18
17
16
15
14
13
19
20
21
22
23
24
Mill Site
T. 41 N.
T. 40 N.
Project Area
General Study Area
T. 40 N.
T. 39 N.
R. 53 E.
R. 54 E.
Vicinity Map
Anticipated New Road Closure Locations within the Project Area
LEGEND
Project Area Boundary
Section Line
Jeep Trail and/or Unimproved Road
Scale in Miles
0
1
2
Map 2.4
11/16/93



LEGEND

- Pits
- Ore Stockpiles
- Haul Roads
- Partial Pit Backfills
- Dumps - Relatively Flat
- Dumps - 3H:1V Slopes
- Dumps - 2H:1V Slopes
- Dumps - Angle of Repose Slopes
- Growth Medium Stockpiles
- Undisturbed Areas
- Existing/Approved Disturbance Boundaries
- Project Area Boundary
- Streams (USGS)
- Major Sediment Ponds/Traps

SCW : 11/13/93

Alternative C
Jerritt Canyon Expansion Project

Scale in Miles
0 1/8 1/4 1/2 1

Map 2.5

be removed in agreement with the USFS. The need for removal of aspen would be determined on a site-specific basis.

- Large aspen in the vicinity of drainage channels in areas of under-dump drains and trench drains would be removed where accessible and operationally feasible.

Stream inflow to and outflow from dumps were also considered in this alternative. Similar to the proposed action, dumps over stream channels would be constructed by end-dumping and an under-dump drainage system would be created by gravity segregation of materials. The inlet and outlet of dump faces located in drainages would be left at angle of repose to promote functioning of the under-dump drainage systems. The dumps south of the Saval and Steer pits would be constructed with 3H:1V slopes along the upper portion of the dump and angle of repose slopes where the dump meets natural topography. The upstream side of the South Deep dump would be constructed as a single level with greater height to promote gravity sorting of waste rock and reduce the possibility of material compaction above the stream inflow point. The single level would be constructed to a height of approximately 130 feet, compared to 40 to 60 feet proposed under Alternative B.

Although potential partial backfilling is a feature common to all alternatives, this alternative displays conceptual partial pit backfill locations. Partial pit backfilling feasibility and locations depend on several factors which would be determined once pit development has begun. For this reason, partial backfilling in West Generator is the only known backfill location at this time since this pit has been mined out. Due to the uncertainties involved in planning for partial pit backfill, waste rock dumps generally are designed to provide sufficient capacity for all of the material from the pits.

The proposed Burns Basin dump expansion was relocated from the Burns Creek drainage to an area north of the pit and would be constructed as an extension of the south Steer dump proposed in Alternative B. The sediment trap proposed for this area under Alternative B would not be constructed.

In addition to the changes that respond to issues, a haul road was added that exits the New Deep pit and parallels Jerritt Creek to the existing Alchem pit.

Except as noted below, reclamation operations for Alternative C would be the same as Alternative B.

- Growth medium would generally be distributed on flat dump tops and 3:1 slopes to a minimum depth of 8 inches. Depth of growth medium may vary as agreed to by the USFS and IMC in order to meet specific reclamation goals or specific situations.

- Angle of repose waste rock dump faces and dump faces steeper than 3H:1V would be armored with coarse and durable waste rock. Growth medium would not be spread onto armored dump faces.

- Except for road sections which may be authorized by the USFS to be left open, mine roads would be closed and reclaimed. All haul roads and access roads would be shaped to as near a natural contour as practicable and be stabilized. Following shaping, roads would be revegetated with a mixture of grasses, forbs, and shrubs.

- Reclamation of dump tops and 3H:1V dump slopes would include the creation of undulating surfaces. The final configuration of these surfaces would include knobs, swells, small hills, and terraces. Design and construction of these features would be done so as not to affect the stability or surface drainage of the waste rock dumps.

- Available slash would be salvaged from accessible pit areas for use in reclamation of existing and proposed disturbances. The final POO would include details on salvaging and methods for redistribution.

Employment levels and duration of the Project for Alternative C are the same as for Alternative B.

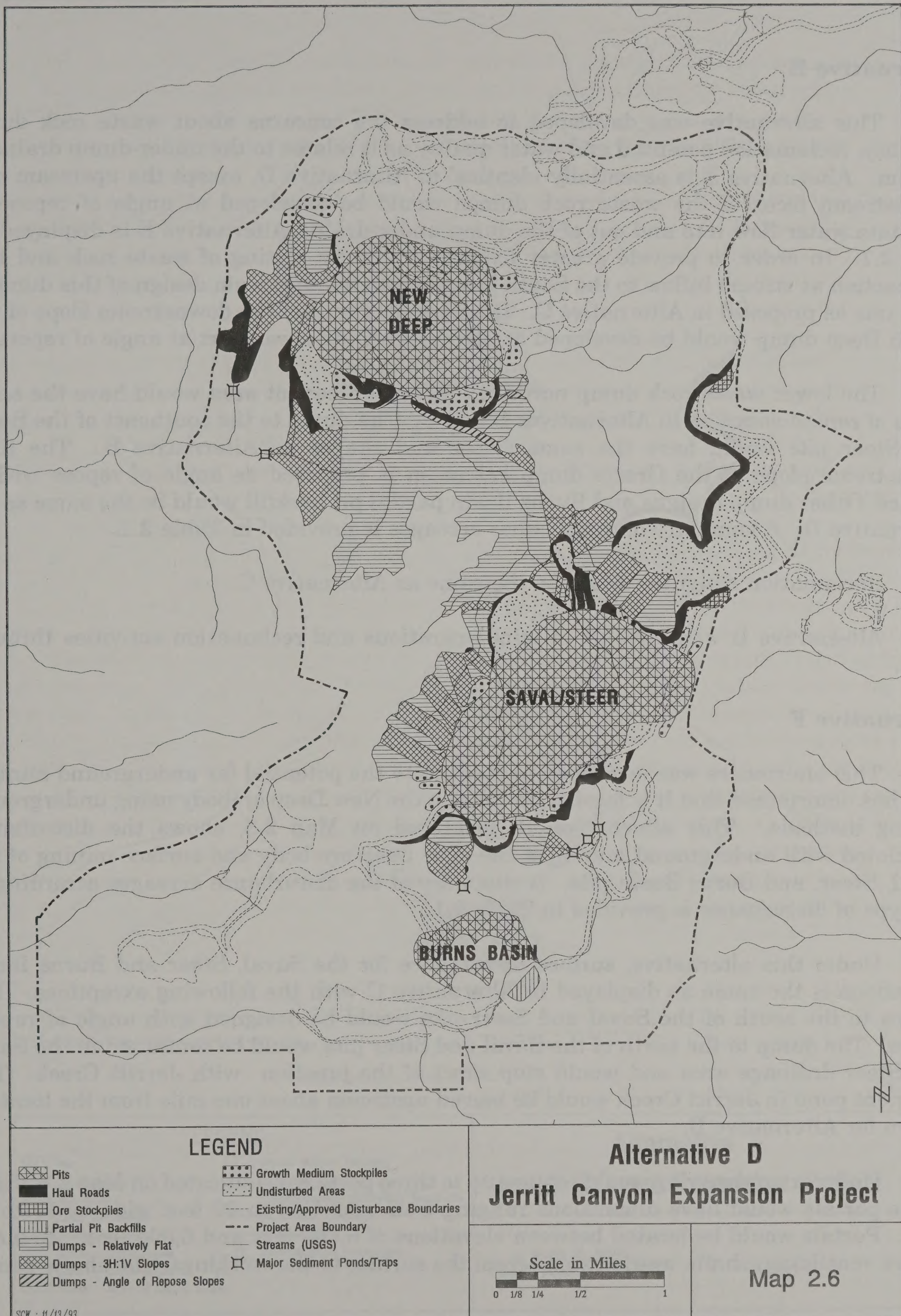
Alternative D

This alternative was developed in response to the waste rock dump stability and reclamation potential focus issues. Under this alternative, all dump slope faces would be graded to 3H:1V slopes, with the exception of the dumps immediately southeast of the New Deep pit which would remain as proposed in Alternative B. Waste rock excavated during the Burns Basin expansion would be partially backfilled in the Burns Basin pit. Developing 3H:1V slopes would require constructing the dumps in multiple levels, which in turn creates the need for about 65 more acres of haul roads, as displayed on Map 2.6. It would be necessary to construct french drains from the base of the angle of repose slopes to the final base of the 3H:1V slopes. Extension of the french drains would be necessary to ensure proper functioning of the under-dump drainage system after the slopes are reduced to 3H:1V. A total of approximately 3,480 feet of french drains would be required. A summary of disturbance acres by disturbance type is displayed in Table 2.1.

As a result of creating 3H:1V slopes, the dump shapes would be altered and expanded by about 105 acres from those in Alternative B. The most significant change is expansion of the South Deep dump downstream in Jerritt Canyon as shown on Map 2.6. An undisturbed area would occur southwest of the New Deep pit, which was proposed for a dump under Alternative B. The sediment trap proposed for the dumps to the north of the Saval and Steer pits is eliminated in this alternative.

Reclamation of the pits, dumps, haul roads, facilities and sediment control structures would be the same as Alternative C.

Alternative D would result in mine operations and reclamation activities through 2006.



NEW DEEP
SAVAL/STEER
BURNS BASIN
LEGEND
Pits
Haul Roads
Ore Stockpiles
Partial Pit Backfills
Dumps - Relatively Flat
Dumps - 3H:1V Slopes
Dumps - Angle of Repose Slopes
Growth Medium Stockpiles
Undisturbed Areas
Existing/Approved Disturbance Boundaries
Project Area Boundary
Streams (USGS)
Major Sediment Ponds/Traps
SCW : 11/13/93
Alternative D
Jerritt Canyon Expansion Project
Scale in Miles
0 1/8 1/4 1/2 1
Map 2.6

Alternative E

This alternative was developed to address the concerns about waste rock dump stability, reclamation potential and water quality as it relates to the under-dump drainage system. Alternative E is essentially identical to Alternative D, except the upstream and downstream faces of the waste rock dumps would be developed at angle of repose to facilitate water flow into and out of the dump under drain. Alternative E is displayed on Map 2.7. In order to provide greater height for gravity sorting of waste rock and less compaction at stream inflow to the South Deep dump, the upstream design of this dump is the same as proposed in Alternative C. The upper portions of the downstream slope of the South Deep dump would be developed at 3H:1V, with the lower part at angle of repose.

The lower waste rock dump north of the Saval/Steer pit area would have the same angle of repose shape as in Alternatives B and C. The dump to the southeast of the Saval and Steer pits would have the same slopes and shapes as Alternative B. The final downstream slope of the Gracie dump extension is proposed as angle of repose with a terrace. Other dump designs and Burns Basin partial pit backfill would be the same as for Alternative D. A summary of disturbance acreages is provided in Table 2.1.

Reclamation activities would be the same as Alternative C.

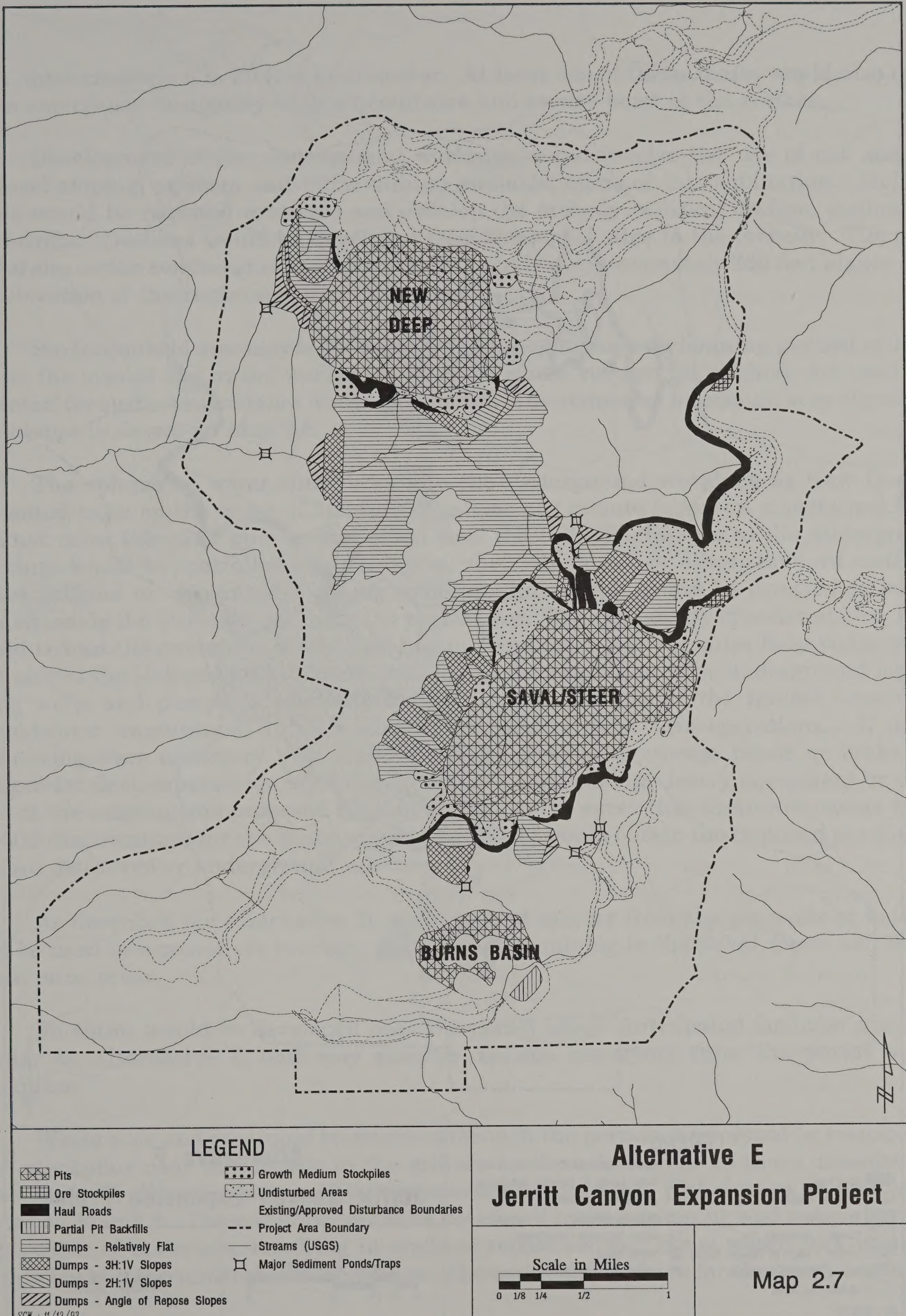
Alternative E would result in mine operations and reclamation activities through 2006.

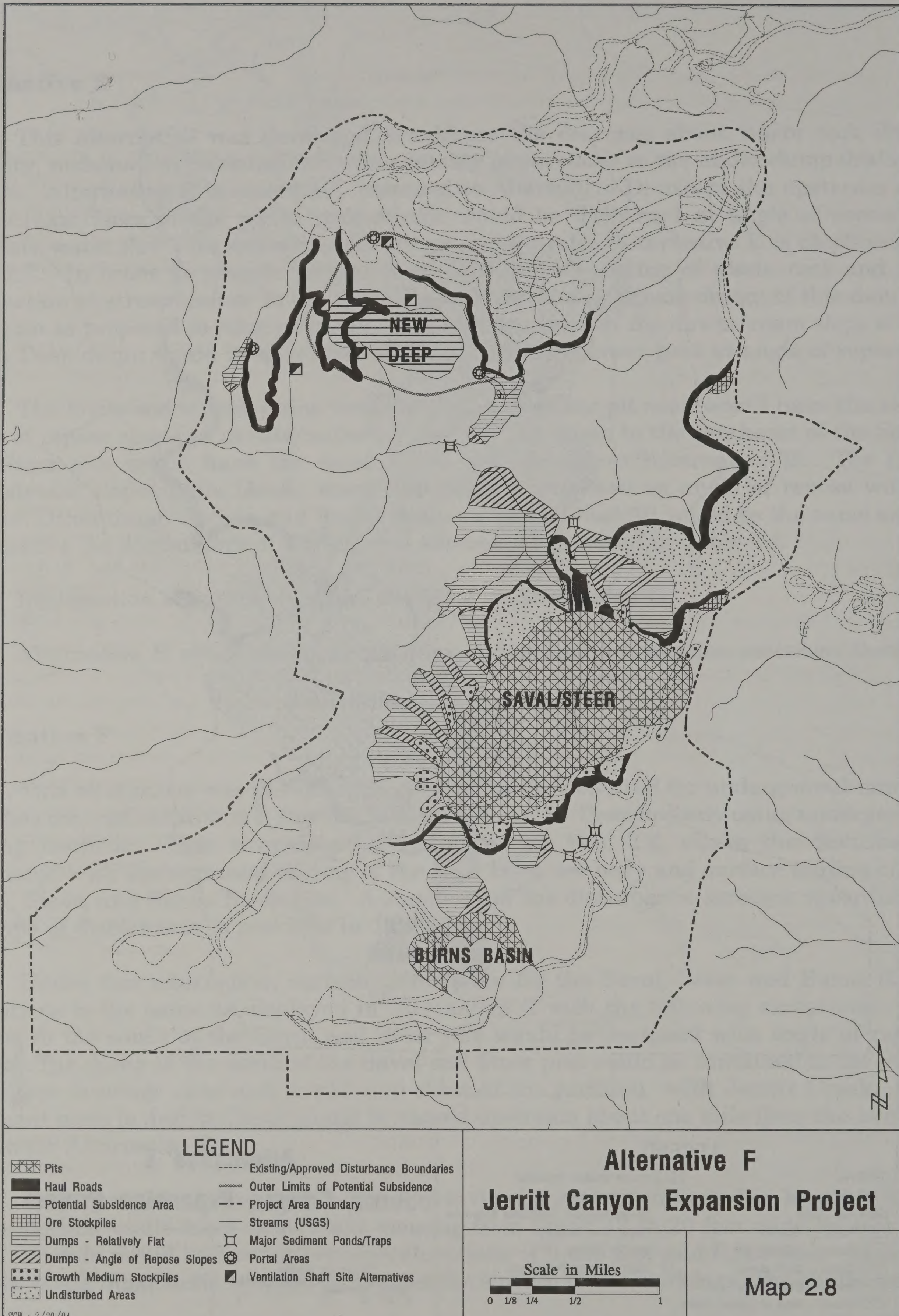
Alternative F

This alternative was developed to respond to the potential for underground mining. IMC has determined that it is feasible to develop the New Deep orebody using underground mining methods. This alternative, as displayed on Map 2.8, shows the disturbance associated with underground mining of the New Deep ore body and surface mining of the Saval, Steer, and Burns Basin pits. A summary of the disturbance acreages according to the type of disturbance is provided in Table 2.1.

Under this alternative, surface disturbance for the Saval, Steer and Burns Basin operations is the same as displayed in Alternative C with the following exceptions. The dumps to the south of the Saval and Steer pits would be designed with angle of repose slopes. The dump to the north of the Saval and Steer pits would be contained in the Saval and Steer drainage area and would stop short of the junction with Jerritt Creek. The sediment pond in Jerritt Creek would be moved upstream about one mile from the location shown for Alternative B.

Underground mining would require up to three portals as indicated on Map 2.8. Each of the portals would have dimensions ranging from about 13 to 20 feet wide by 15 to 20 high. Portals would be located between elevations of 6,400 feet and 6,800 feet. As many as five ventilation shafts would extend from the surface to the workings. The shafts range


NEW DEEP
SAVAL/STEER
BURNS BASIN
LEGEND
Pits
Ore Stockpiles
Haul Roads
Partial Pit Backfills
Dumps - Relatively Flat
Dumps - 3H:1V Slopes
Dumps - 2H:1V Slopes
Dumps - Angle of Repose Slopes
Growth Medium Stockpiles
Undisturbed Areas
Existing/Approved Disturbance Boundaries
Project Area Boundary
Streams (USGS)
Major Sediment Ponds/Traps
SCW : 11/13/93
Alternative E
Jerritt Canyon Expansion Project
Scale in Miles
0 1/8 1/4 1/2 1
Map 2.7


NEW
DEEP
SAVAL/STEER
BURNS BASIN
N
LEGEND
Pits
Haul Roads
Potential Subsidence Area
Ore Stockpiles
Dumps - Relatively Flat
Dumps - Angle of Repose Slopes
Growth Medium Stockpiles
Undisturbed Areas
Existing/Approved Disturbance Boundaries
Outer Limits of Potential Subsidence
Project Area Boundary
Streams (USGS)
Major Sediment Ponds/Traps
Portal Areas
Ventilation Shaft Site Alternatives
SCW : 3/30/94
Alternative F
Jerritt Canyon Expansion Project
Scale in Miles
0 1/8 1/4 1/2 1
Map 2.8

from approximately 6 to 20 feet in diameter. At least one of these shafts would also serve as an emergency escapeway with a headframe and escape hoist at the surface.

Development of the underground workings would involve the use of cut and fill, sublevel stoping, or room and pillar mining methods, alone or in combination. Multiple levels would be required to access and develop the orebody utilizing decline, incline and level drifts. Declines would be developed from the portal sites to the orebody. The main portal site on the southeast side of the orebody would be approximately 360 feet higher than the elevation of the regional water table.

Surface subsidence may occur regardless of the underground mining method utilized, due to the overall size of the workings. In areas where cut and fill methods are used, the potential for surface subsidence would be reduced. The estimated maximum area of possible subsidence is shown on Map 2.8.

The volume of water that flows into the underground workings at New Deep is estimated to be on the order of 100 to 150 gallons per minute (gpm) on a sustained basis and not more than 250 gpm at any given time (HCI 1993). Inflows to the underground workings would be controlled using concrete, shotcrete, grout, or other standard methods. Water utilized or encountered during underground mining would be directed to sumps located inside the workings and near the portal sites. The availability of water at New Deep would reduce the amount of water that has to be pumped over six miles from wells on the east side of the Independence Mountains. Active dewatering prior to underground mining using wells and pumps is currently not anticipated because of the limited amount of groundwater encountered to date during the underground test operations. If active dewatering were necessary, the water would be pumped to storage ponds or tanks and utilized for dust suppression, exploration drilling, and washing heavy equipment or other uses at the existing and proposed mine facilities. In the event that there was excess water beyond that required for the mining operations, IMC would obtain the required permits for surface discharge or underground injection.

As described for Alternative B, underground mining from the pit walls or bottoms may be used to increase ore recovery during or after mining in the Saval, Steer and Burns Basin mine areas.

Facilities would be developed near the portal sites. Anticipated facilities would be similar to Alternative B and may possibly include conveyors from the portal to ore stockpiles.

Waste rock and ore would be removed through the portals. Ore would be transported from stockpiles near the portals to the mill on haul roads similar to those described for Alternative C. Waste rock would be transported to the waste rock dumps on haul roads shown on Map 2.8. These dumps would be developed by end-dumping and natural gravity segregation of materials, resulting in angle of repose slopes. Some waste rock would be used to backfill the underground workings. The under-dump drain for the small waste rock

dump in Jerritt Creek would be pre-constructed with material from the open pit operations to ensure proper drainage material size.

Bulkheading, blasting, or other effective methods would be used to permanently seal the portals and ventilation shafts after underground mining was completed. Earthen berms or steel grating would be utilized alone or in combination to prevent access to the ventilation shafts. Depending on the nature and extent of surface subsidence, appropriate access restrictions and reclamation measures would be implemented. Other reclamation activities would be the same as described for Alternative C.

Alternative F would result in mine operations and reclamation activities through 2004. Approximately 150 new positions would be created.

Alternative G

This alternative was developed to display the combined effects of using both underground mining and surface mining techniques for the New Deep orebody. The Saval and Steer pits along with the Burns Basin expansion would be the same as described under Alternative B. This alternative is displayed on Map 2.9 as a combination of Alternative B and Alternative F. Development of the western most portal site would result in additional disturbance as compared to Alternative B. It is unlikely that if both surface and underground mining were to occur that surface disturbance would be the total of both operations. However, throughout this analysis, Alternative G impacts are based on the total combined surface disturbances of Alternatives B and F.

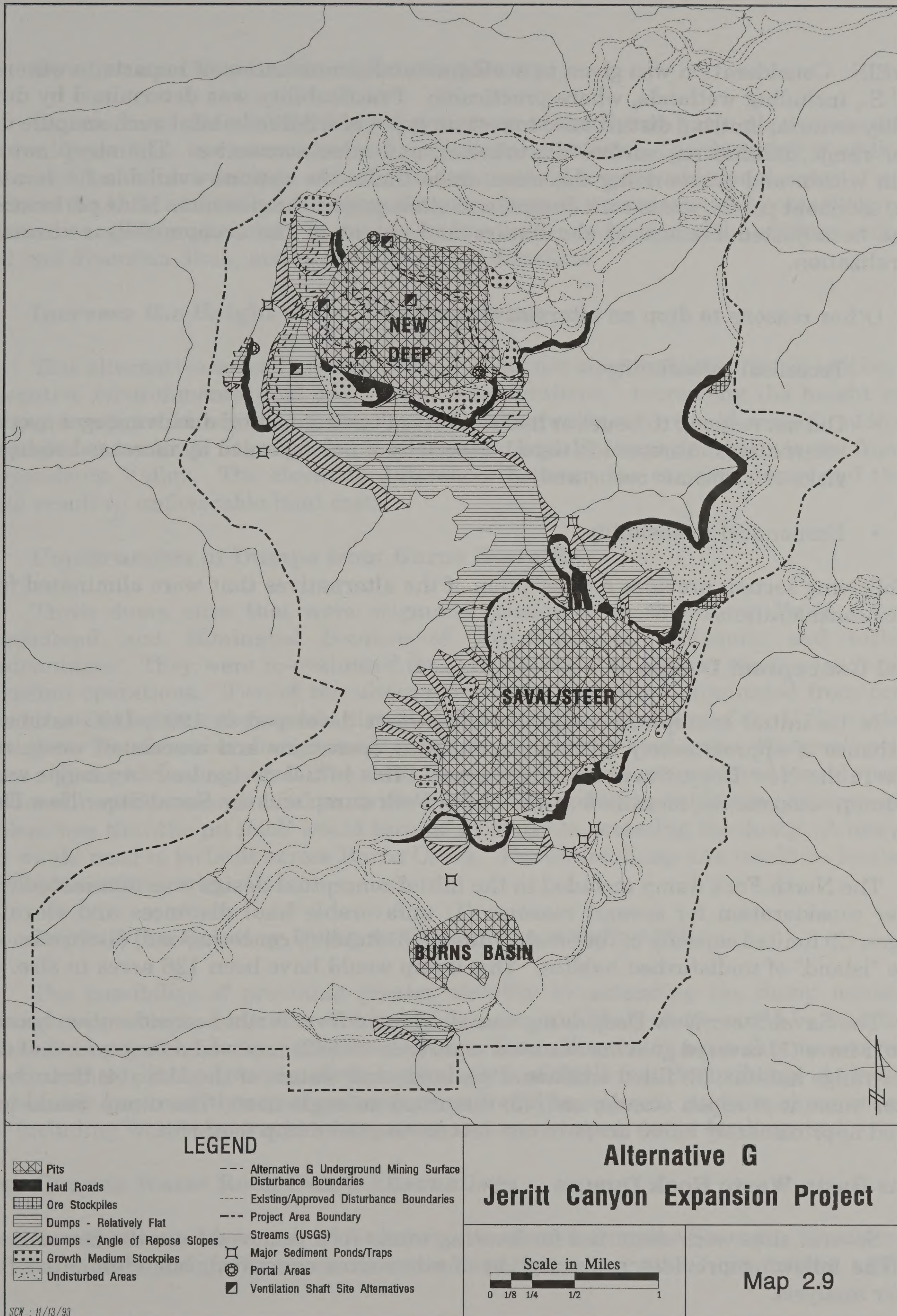
Underground mining methods may also be used in the Saval, Steer, New Deep and Burns Basin pits during or after surface mining to increase ore recovery. Portal sites for these operations are not known at this time. Use of such methods may require an amendment or modification to the POO and USFS approval before implementation.

Under this alternative, it is assumed that surface mining operations would be the same as under Alternative B. The methods used to seal portals remaining after mining and restrict access to ventilation shafts and subsidence areas would be the same as described for Alternative F. Reclamation would be consistent with the methods described for Alternative B.

Alternative G would result in operations through 2005 as in Alternative B, but would create 200 to 300 new positions.

2.5 Alternatives Eliminated from Detailed Study

The IDT reviewed many alternatives that were eventually eliminated from further consideration because of environmental or operational constraints. These alternatives were based on the assumption that pit locations and configurations could not change, but that the waste rock dump and haul road locations and designs could change in response to various issues. A variety of factors were examined during the development of the alternatives for


NEW
DEEP
SAVAL/STEER
BURNS BASIN
LEGEND
Pits
Haul Roads
Ore Stockpiles
Dumps - Relatively Flat
Dumps - Angle of Repose Slopes
Growth Medium Stockpiles
Undisturbed Areas
Alternative G Underground Mining Surface Disturbance Boundaries
Existing/Approved Disturbance Boundaries
Project Area Boundary
Streams (USGS)
Major Sediment Ponds/Traps
Portal Areas
Ventilation Shaft Site Alternatives
SCW : 11/13/93
Alternative G
Jerritt Canyon Expansion Project
Scale in Miles
0 1/8 1/4 1/2 1
Map 2.9

the DEIS. Consideration was given to avoidance and minimization of impacts to waters of the U.S., including wetlands, where practicable. Practicability was determined by dump stability criteria, limiting disturbance to certain types of wildlife habitat such as mule deer winter range, minimizing surface disturbance, and mine economics. The steep natural terrain within and surrounding the mine areas limits the options available for locating roads, sediment ponds, waste rock dumps, and other project components. Mine pit locations cannot be adjusted because of the nature and extent of the economically recoverable mineralization.

Other reasons to drop an alternative were:

- Technical infeasibility;
- Did not respond to issues or had significant environmental disadvantages over the alternatives discussed in detail, especially if accompanied by increased technical risks or economic costs; and
- Economical infeasibility.

The following section provides a description of the alternatives that were eliminated from further consideration.

Initial Conceptual Design

In its initial conceptual design for the project developed in 1991, IMC estimated disturbance of approximately 4,900 acres for mine operations and associated waste rock dumps in the New Deep, Saval and Steer areas. This initial design had two major waste rock dump components, identified as the North Fork dump and the Saval/Steer/New Deep dump.

The North Fork dump included in the initial conceptual design was eliminated from further consideration for several reasons: (1) unfavorable haul distances and elevation changes; (2) limited capacity of the sidehill dump; (3) stability concerns; and, (4) the removal of one "island" of undisturbed habitat. This dump would have been 126 acres in size.

The Saval/Steer/New Deep dump was eliminated from further consideration because it would have (1) covered gold ore reserves and resources; (2) removed a larger area of deer winter range habitat; (3) filled additional wetlands and waters of the U.S.; (4) disturbed a greater amount of aspen stands; and, (5) disturbed an eagle nest. The dump would have covered approximately 3,360 acres in one interconnected dump footprint.

Burns Basin Waste Rock Dumps

Several sites were examined for locating waste rock removed from the Burns Basin pit. The following provides a description of other sites examined, but eliminated from further analysis.

Downstream Expansion of Existing Dump

Expansion of the existing dump downstream of the Burns Basin pit was considered but would result in environmental and operational problems. The dumping of additional waste rock to the downstream side of the dump would impact additional acres of aspen, waters of the U.S., and wetlands. Expanding the dump downstream could potentially result in disturbance of a raptor nest. It would also involve the relocation of the existing sediment pond and diversion ditch, and unfavorable haul distances.

Increase the Height of the Existing Dump

This alternative was eliminated because it did not meet stability criteria and because of negative environmental and operational considerations. Increasing the height of the existing dump would result in limited additional capacity, and would require additional dump sites as back-up. It could also result in visual quality impacts when viewed from the Independence Valley. The elevation differences between the existing dump and the pit would result in unfavorable haul costs.

Construction of Dumps from Burns Basin EA

Three dump sites that were originally considered in the Burns Basin EA were reconsidered and eliminated because of environmental, economic, and technical disadvantages. They were re-evaluated for their potential to contain waste rock from the expansion operations. Two of the alternative dump sites were eliminated from further considerations because they would disturb additional acres of waters of the U.S., wetlands, and aspen. The elevation change would result in unfavorable haul costs. The area partially covers a geologic resource area. The third dump site that was reconsidered would result in additional impacts to aspen and to waters of the U.S., including wetlands. An operational problem was that the pit itself would become a barrier to accessing the dump. A new haul road would need to be built across Burns Creek. The entire dump site would be located on a geologic resource area.

Expand the Existing Dump to Create Cross-Valley Fill

The possibility of providing greater stability by extending the dump across the drainage was examined but was eliminated because it is likely there would be insufficient material to extend the dump across the drainage. Extending the dump in this manner would also cover the existing diversion ditch located south of the Burns Basin dump. At least one and possibly two recently active goshawk nests would be covered. Additional waters of the U.S. including wetlands, would be impacted and more aspen would be disturbed.

Steer Canyon Waste Rock Dump Alternatives

Several sites were examined for locating waste rock from the Steer pit. The following provides a description of various sites examined, but eliminated from further analysis.

Locations of select alternative dump sites eliminated from further study are shown on Map 2.10.

Haul Waste to Burns Pit and Backfill

This alternative was eliminated because the haulage distances would make the project uneconomical.

Avoid Waters of the U.S. Including Wetlands

Creating sidehill dumps to avoid the Steer Canyon drainage resulted in slopes that did not meet dump stability criteria. The dumps would not have the capacity to contain the full volume of waste rock.

Develop Dump in Headwaters of Steer Canyon

In order to fully utilize the Steer Canyon drainage for waste rock disposal, the alternative of creating a head-of-valley dump was considered. This option would require an extensive haul road network and unfavorable haulage distance. In addition, there would be additional aspen removed.

Develop Dump Northwest of Steer Pit

This alternative was considered as a means of reducing the area of the waste rock dumps in Steer Canyon. It was eliminated because it required construction of additional roads, unfavorable haul distances and a causeway to be built across Steer Canyon to access the dump site.

Move Dumps from Steer Canyon

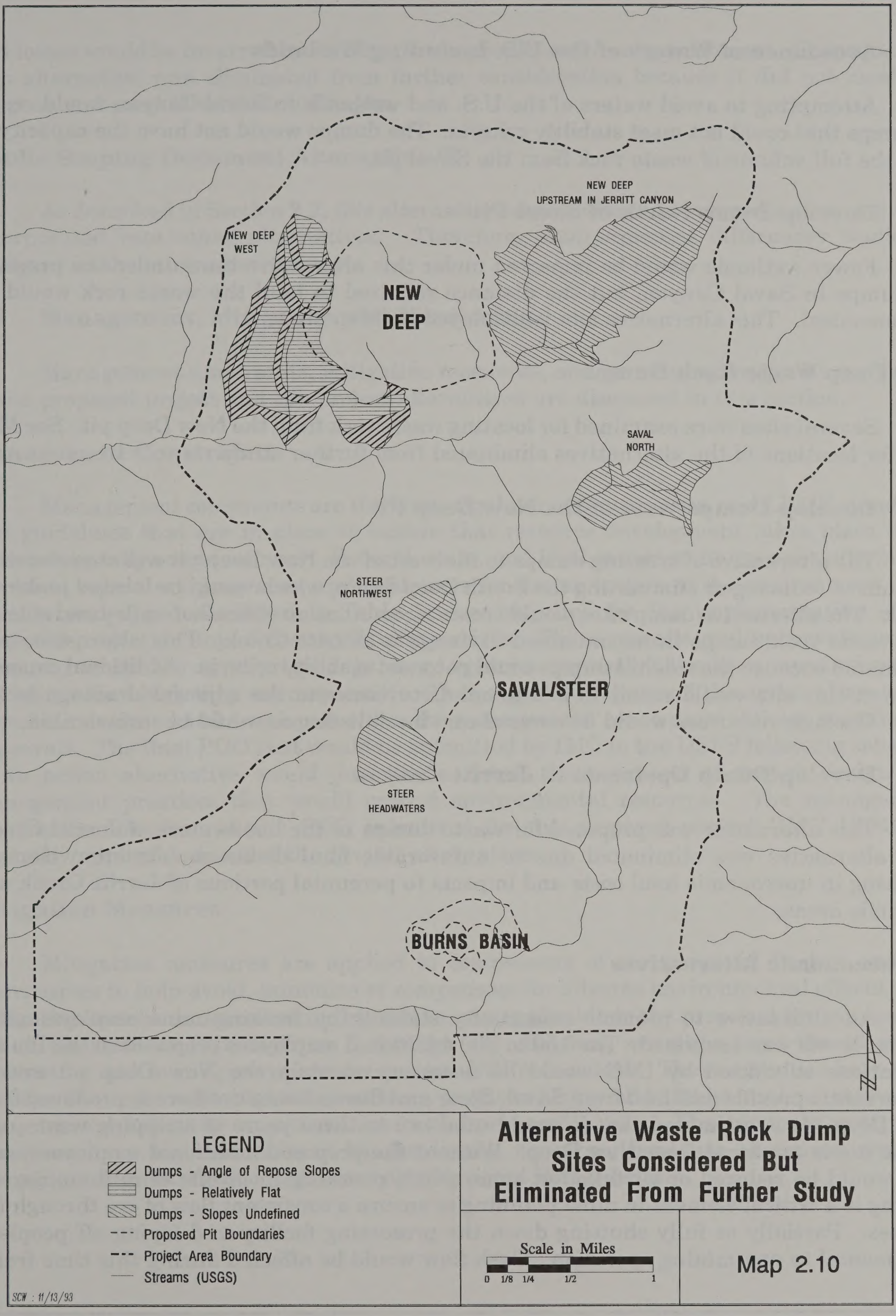
Completely eliminating all dumps in Steer Canyon and moving the waste rock to other locations was also considered. This alternative was infeasible due to the volume of waste rock and haul costs to other locations.

Saval Canyon Waste Rock Dumps

Several sites were examined for locating waste rock from the Saval pit. The following provides a description of various sites examined, but eliminated from further analysis.

Haulage to Pattani Pit for Partial Backfilling

This alternative was eliminated due to unfavorable haulage distances, elevation changes resulting in unfavorable haul costs, disturbance of previously reclaimed areas, and limited capacity for additional waste rock storage.


NEW DEEP
UPSTREAM IN JERRITT CANYON
NEW DEEP
WEST
NEW
DEEP
SAVAL
NORTH
STEER
NORTHWEST
SAVAL/STEER
STEER
HEADWATERS
BURNS BASIN
LEGEND
Dumps - Angle of Repose Slopes
Dumps - Relatively Flat
Dumps - Slopes Undefined
Proposed Pit Boundaries
Project Area Boundary
Streams (USGS)
SCW : 11/13/93
Alternative Waste Rock Dump Sites Considered But Eliminated From Further Study
Scale in Miles
0 1/8 1/4 1/2 1
Map 2.10

Avoidance of Waters of the U.S. Including Wetlands

Attempting to avoid waters of the U.S. and wetlands in Saval Canyon would result in dumps that could not meet stability criteria. The dumps would not have the capacity to hold the full volume of waste rock from the Saval pit.

Develop Dump North of Saval Pit

Fewer wetlands would be impacted under this alternative than under the proposal for dumps in Saval Canyon, but the distance required to haul the waste rock would be uneconomical. This alternative site is displayed on Map 2.10.

New Deep Waste Rock Dumps

Several sites were examined for locating waste rock from the New Deep pit. See Map 2.10 for locations of the alternatives eliminated from further study.

Develop Dumps West of the New Deep Pit

The alternative of creating dumps to the west of the New Deep pit was considered as a means of reducing or eliminating the South Deep dump, which would be located in Jerritt Creek. The alternative dump sites would create a combination of head-of-valley and sidehill type waste rock dumps in an unnamed drainage to Jerritt Creek. This alternative was eliminated because the sidehill dumps could not meet stability criteria. Additional capacity needs at this site would result in additional disturbance to the adjacent drainage to the west. Geologic resources would be covered and haul distances would be unfavorable.

Develop Dump Upstream in Jerritt Canyon

This alternative was proposed for waste dumps in the headwaters of Jerritt Creek. This alternative was eliminated due to unfavorable haul distances, elevation changes resulting in uneconomic haul costs and impacts to perennial portions of Jerritt Creek and wetlands areas.

Socioeconomic Alternatives

An alternative to promote community stability by freezing mine employment at current levels was examined. The 150 to 200 additional employees proposed in the Plan of Operations submitted by IMC would be necessary to strip the New Deep pit and to concurrently provide mill feed from Saval, Steer and Burns Basin until ore is produced from New Deep. It is estimated that it would take two to three years of stripping waste rock before ore is produced from New Deep. Without the proposed additional employees, mill feed would be reduced or curtailed at some point, resulting in layoffs of mill employees. Timing is a critical element in mine planning to ensure a consistent flow of ore through the process. Partially or fully shutting down the processing facility and laying off people is detrimental to any mining operation. Cash flow would be affected during this time frame

and losses would be incurred by vendors, townspeople, and local government. Consequently, this alternative was eliminated from further consideration because it did not meet the purpose and need identified in Chapter 1.

Public Scoping Document Alternative C

As described in Section 2.2, this alternative was eliminated because its elements were incorporated into other alternatives. Therefore, environmental differences would be analyzed in the other alternatives.

2.6 Management, Mitigation and Monitoring

Management constraints, mitigation measures, and monitoring programs applicable to the proposed project and the project alternatives are discussed in this section.

Management Constraints

Management constraints are the laws, regulatory requirements, and LRMP standards and guidelines that are in place to ensure that resource development takes place in an environmentally sound manner. Federal, state, and local government agencies administer the laws, regulatory programs, and guidelines for the protection of the environment. The permits and approvals listed in Table 1.1 are required for the implementation of the proposed project or any of the action alternatives. These permits and approvals are the means by which the appropriate regulatory agencies implement the laws, regulations and guidelines for which they are responsible. The proposed Project and the action alternatives have been designed and developed within the management constraints of these permits and approvals. The final POO that would be submitted by IMC to the USFS following selection of an action alternative would describe in detail those aspects of project design and management practices that would protect environmental resources. The management constraints described in the POO submitted for the proposed project (IMC 1993) are generally applicable to all of the Project alternatives.

Mitigation Measures

Mitigation measures are applied to components of the proposed Project and the alternatives to help avoid, minimize or compensate for adverse environmental effects. The mitigation measures described in this section are applicable to the proposed Project and the action alternatives (Alternatives B through G). Existing activities form the no action alternative and were approved under various NEPA decisions. These activities have their own specific approved mitigation measures, most of which would also be implemented under the proposed action or an alternative to the proposed action. The proposed mitigation measures have been formulated by the issues, concerns, land use objectives and the management constraints of the Humboldt National Forest LRMP.

Monitoring Programs

Monitoring programs for the proposed action and the alternatives would be implemented to ensure that environmental safeguards are executed according to plan, necessary adjustments are made to achieve desired environmental effects and anticipated results are reviewed. Monitoring programs help ensure that decisions by the responsible officials are implemented, including mitigation measures and conditions in permits and approvals. The objective of the monitoring programs is to detect changes in environmental conditions and take corrective action in a timely manner. Results of monitoring programs are incorporated into the existing information base to more readily assess the effects of the mitigation measures. The results of relevant monitoring would be presented to the regulatory agencies on a regular basis.

Monitoring programs are currently in place for the existing mining operations, and are conducted by IMC in conjunction with the USFS, cooperating agencies, and the State of Nevada regulatory agencies. IMC would expand existing monitoring programs to include the proposed new mine areas. New monitoring programs, if required, would be designed and initiated in cooperation with the appropriate regulatory agency. Monitoring of baseline environmental conditions has also been conducted in the preparation of this FEIS. Some of the baseline studies would be continued as monitoring programs throughout the life of the Project and during and after reclamation.

Under all alternatives, a quality assurance/quality control (QA/QC) program would be implemented for the new mine areas by IMC in cooperation with the USFS. The QA/QC inspections would be designed to monitor compliance with the final approved POO.

Mitigation and Monitoring Measures Applicable to All Action Alternatives

The following mitigation measures and monitoring programs were proposed by IMC as part of the proposed action or were developed to respond to impacts identified during the EIS effects analysis process. They are organized by environmental resources and are discussed in the same order that resources are discussed in Chapters 3 and 4. Focus issues identified for the proposed project and the alternatives are discussed in more detail within the appropriate resource category.

Geology

Geochemistry

The potential for the waste rock dumps, pit walls, and ore stockpiles remaining after mining to release acidic waters or trace elements has been identified as a focus issue. The potential to generate acidic waters has been evaluated under a waste rock characterization program, including kinetic testing. Results of the static and kinetic testing program were used to develop a waste rock evaluation program that would guide additional sampling, analysis, handling and placement of materials determined to be acid forming. This monitoring program would be incorporated into the final POO.

Geotechnical Considerations

Waste rock dump stability has been identified as a focus issue for the proposed project. Various engineering design and construction techniques are used to address the geotechnical and stability considerations, including pseudostatic (seismic) stability, mass stability, foundation stability, surface stability, long-term drainage control, and erosion control on waste rock dumps and other project components. Implementation of these techniques would provide for project components that are structurally competent under anticipated geologic and climatic conditions.

The waste rock dump designs may be modified from the configurations shown in Chapter 2 as site specific conditions or constraints dictate. This would allow for variations in the pit dimensions that may result in reductions to anticipated waste volumes, changes in the characteristics of the waste rock, or placement of waste rock in partial pit backfill areas. Waste rock dumps would meet stability requirements even if the dumps do not approximate the shape displayed in this FEIS. The final design would not exceed the approved waste rock dump footprints. Slopes that were approved at 2H:1V or 3H:1V would not be modified to steeper angles. Upon completion of a dump, no unbuttressed angle of repose slope would have its toe on a foundation that is steeper than 30 percent.

The waste rock dumps would be constructed by end dumping. The advancing face of the dumps would be at the angle of repose, estimated to be approximately 1.3H:1V. Waste rock dump design would include under-dump drainage systems to enhance physical stability and to encourage surface water flow through the dumps. Waste rock dump stability and hazard analyses have been performed to identify which design and construction techniques would be appropriate to achieve stable final configurations. Dumps with angle of repose slopes would meet factors of safety that are acceptable to the USFS. Under Alternatives C, D, and E, some of the angle of repose waste rock dumps would be regraded to an overall slope of 3H:1V, which would further enhance stability.

Erosional stability of final 3H:1V dump slopes would be achieved by revegetation. Surface drainage and erosional stability of the 2H:1V and angle of repose dump slopes would be achieved by armoring with coarse and durable material.

The size and durability of material that would be placed in the under-dump drainage systems would be controlled during operations. This material would be large enough to remain in place while providing passage for a 100 year storm event through the waste rock dumps. A definition of coarseness and durability in measurable terms would be developed. These specifications would be based on standard engineering durability tests performed on representative samples of the various rock formations or subunits within formations. The geochemistry of material that would be placed in the under-dump drain would also be evaluated under the waste rock evaluation program. Fine materials that would adversely affect dump stability and the under-drain would be placed in non-critical portions of the waste rock dump areas.

Springs and seeps identified within the drainage bottoms would be covered by the under-dump drainage system. Springs and seeps on hillsides outside of the drainage bottoms would be drained by foundation trenches that extend to the nearest drainage bottom or beyond the dump perimeter.

Other project components would also be designed to be stable and structurally competent. The pit would be mined using conventional open-pit methods that include drilling, blasting, loading and hauling from a series of benches. The walls of the pit would be left in a stable configuration with an overall slope of 30 to 57 degrees and 20 to 100 foot wide benches. Haul roads would be designed and constructed with drainage control structures such as ditches, culverts, and sediment control basins that would reduce erosion and enhance the stability of the roads.

Monitoring

Monitoring of geotechnical aspects during construction and operation would be accomplished primarily through implementation of the QA/QC program. The under-dump drain material would be monitored during waste rock dumping. The size and durability of material placed in the drain would be evaluated visually and documented through photographs and other visual aids. These visual records would become part of the QA/QC inspection reports and would be submitted to the USFS. Monitoring of the coarse and durable material to be applied to the angle of repose dump surfaces and placement of fine materials in specified dump locations would take place under the QA/QC program. The condition of active haul roads and access roads would be monitored during weekly mine operations self-inspections, and appropriate corrective actions would be taken as necessary. This would be in addition to the normal USFS administration of the Project area.

Soils

The goal of the growth medium salvaging and stockpiling operations would be to remove sufficient quantities to cover the acreages specified in the reclamation plan. Growth medium is defined as the A, E, B, and C soil horizons or underlying materials that are suitable for plant growth. Soils would be salvaged during pit development from those portions of the proposed pits with slopes less than 30 percent with a sufficient thickness of soil to enable salvaging. Growth medium would be recovered from portions of the proposed pits with slopes greater than 30 percent where feasible. Direct redistribution would be used wherever possible to enhance soil productivity, expedite reclamation, and reduce double handling. Growth medium that cannot be redistributed would be stockpiled. These stockpile areas are located as close as possible to the removal and redistribution areas to minimize new disturbance to the extent possible. Stockpiled soils would be interim seeded and stabilized with silt fences or berms to retain the soil materials and control wind and water erosion. Preliminary estimates of available growth medium based on depth to bedrock and soil mapping in the Project area indicate that a sufficient quantity of soil is available to meet the projected needs.

Soil suitability for growth medium would be determined visually in the field during growth medium salvaging. This evaluation system would be based on soil characteristics such as color, texture, percent rock, soil depth, associated vegetation community type, and other easily recognized features. Nutrient characteristics of redistributed growth medium would be evaluated using standard soil tests. Fertilizer would be applied as necessary to enhance seeding success.

Protection of soil resources in the Project area would be accomplished through use of control measures such as silt fences, water bars, sediment traps, culverts, ditches and interim, concurrent, and final revegetation. Ongoing maintenance of these measures throughout construction and operation of the Project would protect soil resources.

Monitoring

Growth medium stockpile volumes are currently and would continue to be monitored on an annual basis. Locations and volumes of existing growth medium stockpiles and projections of future stockpiling would continue to be reported to the USFS in the Annual Work Plan submitted by IMC each year.

Air Quality

IMC would comply with applicable state and federal regulations pertaining to air quality. This would be accomplished through use of fugitive dust control measures as part of construction, mining and reclamation activities. These measures would include: 1) periodic watering of haul roads, construction roads, and unpaved access roads on a seasonal basis utilizing water trucks or other equally effective means; 2) chemical stabilization of unpaved roads through use of magnesium chloride or similar substances; 3) controlling emissions from stationary sources such as rock crushing and screening facilities; and 4) revegetation.

Monitoring

Fugitive dust emissions from haul roads and crushing activities would be monitored visually. Source testing would be conducted at the mine crushing and screening facilities if current production rates were to increase substantially. The source testing would be used to determine compliance with applicable air quality permits.

Surface Water Resources

Surface Water Quality

A variety of methods would be used to comply with state and federal water quality standards or to meet baseline conditions. The measures used would be designed to reduce introduction of sediment into surface waters and minimize the potential to introduce chemical contaminants into surface waters.

The objective of the sediment control measures would be to retain sediment within disturbed areas or to capture sediment as close to the source as possible. Sediment control measures would consist of practices such as: disturbing the smallest practicable area during mining through mine design and concurrent reclamation practices; stabilizing disturbed areas where possible to reduce the rate and volume of runoff; intercepting and treating runoff from disturbed areas to prevent sediment from leaving the site; and diversion of runoff around disturbed areas during mining where feasible. Runoff would be intercepted by use of straw dikes, riprap, check dams, mulches, vegetative sediment filters, silt fence, and erosion control fabric. These structures would also serve to decrease overland flow velocities, reduce runoff volumes and trap sediment. Sediment ponds, traps and/or sumps would be used alone or in series at appropriate locations to control sediment. Road crossings of waters of the U. S. would be designed, constructed, maintained and reclaimed to comply with the Corps Nationwide Permit 14 requirements through such measures as installing culverts, rock-armored crossings, or other effective measures. Final locations and design specifications of sediment control structures would be field-reviewed with the USFS prior to construction. Sediment control structures would be examined and maintained on a regular basis. Materials removed from sediment control structures would be disposed in a location approved by the USFS.

A waste rock characterization and handling program would be implemented during mining to guide the selective handling and placement of potentially acid-forming materials. Implementation of this program is intended to prevent degradation of surface water quality. An overview of this program is included in Appendix F of this FEIS. In order to minimize the potential for impacts to surface water quality from on-site spills involving petroleum products, a Spill Prevention Control and Countermeasure Plan (SPCCP) has been developed by IMC as part of the POO. The SPCCP outlines the procedures and equipment in place to prevent oil spills from entering navigable waters of the United States. A contingency plan is in place to ensure timely, efficient, coordinated and effective action to minimize environmental damage. The plan details a variety of cleanup and remediation strategies to be implemented in the event of an oil spill.

Surface Water Quantity

Mitigation of potential effects to surface water quantity would be accomplished by routing surface water through or around mine disturbance areas. Waste rock dumps placed in drainages would be constructed with an under-dump drainage system. This drain would be constructed and maintained during operations so that surface water is conveyed through the dump. Resolution and mitigation of water quantity (water rights) issues that may arise from the potential reductions in surface flow are the legal responsibility of the State Engineer's Office, Nevada Division of Water Resources. A system is in place within this state agency to address impacts to water rights.

Monitoring

Surface water quality and quantity are and would continue to be monitored at specific locations determined in cooperation with the USFS. Water quality would be monitored to

determine compliance with applicable state and federal water standards or baseline conditions. The monitoring program would include existing sites on Burns Creek and Jerritt Creek. Event-based samples would be collected at selected stations using single-stage sediment samplers to provide data representative of water quality during storm events. The water monitoring program is included in Appendix B.

Results from the surface water monitoring program are and would continue to be provided in the Annual Work Plan, which would be submitted to the USFS each year. Surface water quality trends identified by the monitoring program would be assessed, reported to the USFS in a timely manner, and acted upon to reduce the impacts to an accepted level.

Monitoring of sediment ponds and roads would also be conducted. Quality control and construction monitoring would be conducted by IMC and USFS personnel. IMC and the USFS would annually review the effectiveness of ongoing erosion and sediment control measures as part of the Annual Work Plan.

Groundwater Resources

Groundwater discharge from springs and seeps that would be covered by the waste rock dumps would be conveyed through the under-dump drainage systems. Flow from springs located on hillsides outside of the drainages would be conveyed to the dump perimeter or nearest drainage using trench drains.

The New Deep pit would extend below the estimated regional groundwater table and groundwater may enter the pit. The quantity of water that would enter the pit is unknown but, based on preliminary estimates, is expected to be on the order of 100 to 300 gpm (HCI 1993). During mining operations, water that collects in the pit would be routed to sumps, utilized at the mine facilities, used for dust suppression, or be discharged or injected into the ground with the required permits and authorization. After mining is completed, groundwater may flow into the New Deep pit and stabilize at or near the pre-mining static water level of approximately 6,100 feet.

The Saval, Steer and Burns Basin pits are not expected to intersect the regional groundwater surface. Groundwater from local perched aquifers may enter the pit and would be routed to sumps in the pits and utilized during mining if sufficient quantities are available.

Monitoring

Water that accumulates in the New Deep pit would be monitored during project implementation and after mining is completed. The pit water monitoring program would be developed and incorporated into the final POO. The Saval, Steer, and Burns Basin pits would be monitored after mining to determine if water would be impounded within the pits. If the pits impound water, the USFS, IMC and NDEP would evaluate the situation to

determine if they should be allowed to retain water or if measures should be taken to provide drainage.

Water quality and quantity of Niagara and Van Norman Springs would also continue to be monitored on a regular basis. Groundwater flow rates for Niagara Spring and Van Norman Spring are highly variable. Monitoring for effects to flow would take into account baseline fluctuations. Resolution and mitigation of water quantity (water rights) issues that may arise from the potential reductions in groundwater flow from springs are the legal responsibility of the State Engineer's office, Nevada Division of Water Resources. A system is in place within this state agency to address impacts to water rights. Monitoring of springs MCDS-10 and GDSP-10 would continue under existing monitoring programs.

Wetlands

Mitigation of impacts to wetlands includes avoiding, minimizing, rectifying, reducing or eliminating, and compensating, as defined in regulations at 40 CFR 1508.20. Development of alternatives and analysis of impacts in this FEIS have incorporated these aspects of mitigation for impacts to wetlands. Wetland areas and waters of the U. S. were avoided to the extent possible during design of the proposed project and the alternatives. Where wetlands would be affected by the Project, impacts would be minimized to the extent possible. A description of potential wetland mitigation, including avoidance and minimization, is included in Chapter 4.

A wetlands mitigation and monitoring plan has been developed by IMC in coordination with various resource agencies (IMC, 1993). The objective of the mitigation plan is to compensate for wetlands impacts in a manner consistent with mitigation guidelines and regulations. Under that plan, IMC would commit to the following measures, to the extent practicable: 1) avoid impacts to wetland habitat; 2) minimize wetland impacts that are unavoidable; 3) replace all wetland habitat that is disturbed with a mitigation ratio of at least 1:1 and as much as 2:1; and, 4) create new wetland habitat with similar functional values to those which were lost. This plan is included in Appendix C of this FEIS.

Monitoring

The QA/QC program to be implemented during project construction and operation would ensure that no additional wetlands are affected beyond those authorized for disturbance by the Corps. Monitoring would also occur under the wetlands mitigation plan that is designed to evaluate whether the created wetlands have been successfully established based on criteria specified in the plan. Monitoring efforts would determine the need for additional planting, seeding, weed control, or physical modification to ensure that success criteria are met. The created wetland sites would be monitored for five years or until the success criteria are met, whichever is greater.

Aquatic Resources and Fisheries

Aquatic habitat maintenance and protection for fisheries habitat would be accomplished through mitigation measures that protect surface water resources, described above. In particular, sediment would be controlled using a variety of sediment control techniques. Riparian habitat enhancement efforts would continue in Jerritt Creek.

Monitoring

Aspects of aquatic habitat would be monitored through the surface water quality and quantity monitoring program. Additional monitoring would include fish populations, macroinvertebrates, and stream characteristics for Burns Creek.

Vegetation

Effects to vegetation resources would be mitigated through implementation of interim, concurrent and final reclamation. IMC's POO describes reclamation measures for pits, waste rock dumps, roads, ore stockpiles, sediment control structures and facilities (IMC, 1993a). These are summarized briefly in the description of Alternative B in this chapter. The POO also describes revegetation goals and procedures that are briefly summarized below.

Areas designated for final revegetation would be seeded with a mixture of grasses, forbs and shrubs. Selection of plant species would primarily focus on controlling erosion, providing forage for wildlife and livestock, and developing portions of the post-mining reclamation areas as specific types of wildlife habitat. Seed mixes would be based on site-specific characteristics (soil type, vegetation community, precipitation, slope, aspect, etc.) with consideration of (1) adapted species (2) diversity of species (typically grasses, forbs, and shrubs), (3) species which enhance natural succession, (4) seed availability, (5) competition, and (6) speed of establishment. Areas where moisture accumulates and sites with a thick layer of growth medium would be given preference for supplemental revegetation with trees and/or shrubs.

Aspen Habitat Fragmentation

Fragmentation of aspen habitat that would occur under the proposed action or the alternatives would be partially mitigated by off-site activities. These activities would include aspen reintroduction into sites that previously supported aspen; treatment of existing aspen stands to improve viability; and assistance to the USFS in riparian area management. These activities may involve fencing.

Monitoring

Reclamation activities would be monitored throughout the operation and through the completion of final reclamation. Operational monitoring of interim reclamation includes qualitative visual assessment of vegetation growth and cover on disturbed areas, and

assessing earthmoving strategies for achieving the long-term reclamation objectives. Reclamation monitoring would be conducted for at least three years to assess vegetative cover and woody plant density on disturbed areas. Revegetation success would be evaluated based on comparison with undisturbed reference areas or by other standard methods. Criteria for successful revegetation would be included in the final POO.

Wildlife

Mule Deer

Impacts to mule deer have been addressed and mitigation is provided for in a Memorandum of Understanding (MOU) between IMC, USFS and NDOW. This agreement identifies funds IMC has and will contribute for deer habitat management activities. This action mitigates for all past, present, and future impacts to mule deer habitat (up to 5,500 acres of long term impacts to mule deer habitat) in the Independence analysis area. In addition, IMC would continue to work with the USFS and NDOW to utilize reclamation practices and plant species in areas to be revegetated that would benefit and support mule deer on mined areas after reclamation.

Sage Grouse

Mitigation for effects to potential sage grouse brooding habitat would include off-site mitigation and habitat enhancement during reclamation. IMC, USFS, NDOW, and BLM have identified sites in the vicinity of Mahala, Stump and California Creeks which can be improved or developed to mitigate the long term loss of potential brooding habitat caused by implementation of any action alternative in this FEIS. A system has been established and would be maintained by the USFS, NDOW, and IMC, to document the number of acres mitigated versus the number of acres disturbed. In addition to off-site sage grouse mitigation, IMC would include plant species recognized as having value to sage grouse in the seed mixtures that would be utilized on appropriate portions of the reclamation areas and in off-site mitigation.

Raptor Habitat

During mining or reclamation, portions of the pit walls would be altered by creating holes or cracks where natural voids and solution cavities are not exposed. This could result in additional raptor nesting or perching sites. The dimensions, locations, and number of holes would be determined in cooperation with the USFS and NDOW.

The proposed mining activities are expected to remove historic goshawk nests 074, 127, and 128 and impact the home range of three other nests. IMC is considering specific mitigation for the loss of the historic goshawk territory that includes nests 074, 127 and 128. Although these nests have not been occupied by goshawks recently, IMC is considering "hacking" nests in suitable unoccupied habitat. If this is considered desirable and feasible by the USFS and NDOW, researchers at a University specializing in raptors would be

contacted for a research project. Potential hack sites, methods or other mitigation measures would be discussed with USFS and NDOW.

Disturbance of the home ranges for goshawk nests 027 and 136 would not exceed the TOC. Home range disturbance for goshawk nest 134 would exceed the short- and long-term TOC's. However, planting of aspen and other woody plant species on portions of the relatively flat dumps and along sections of the recontoured haul roads is proposed to develop suitable habitat for goshawks and other wildlife species. Rodent populations may increase within the waste rock dump sites after mining is completed, which would provide additional prey for goshawks.

Boulder piles would be constructed at select locations on the dump surfaces to simulate rock outcrops. The boulder piles would create raptor perches and provide cover for small mammals.

Cavity Nester Habitat

Impacts to cavity nester habitat would be mitigated by various methods. Some aspen trees would be removed prior to dump and pit construction. These trees may be placed on-site as the dead and down component of aspen communities or windrowed as wildlife habitat. IMC would plant aspen in suitable areas both on-site and off-site. Artificial nesting boxes or snags would be placed on-site or off-site to replace some lost structures.

Riparian Habitat

IMC has agreed to fund and carry out a habitat enhancement program within the Jerritt Creek watershed. This program would be expanded to cover other drainages within the Project area. The goal of this program is to enhance the ability of riparian vegetation to maintain streambeds and banks and regulate water flows and timing. This would be accomplished by the following methods: 1) continue concurrent and interim reclamation of exploration roads throughout the watershed; 2) plant a variety of adapted shrubs and trees within the riparian zone and sideslopes; 3) continue final and/or interim reclamation of mining areas; and 4) identify potential sites lower in the watershed for additional plantings and streambank stabilization. Off-site enhancement of existing riparian areas would occur through planting of species such as elderberry and chokecherry.

Other Wildlife Species

Other mammal habitat mitigation would include the creation of undulating dump surfaces and placement of rock piles on the dump surfaces. Creating holes in portions of the pit walls may also result in additional bat roosting sites.

Monitoring

The wildlife mitigation measures to be implemented with the proposed project would be monitored as part of the QA/QC program. IMC would report the mitigation measures

implemented during the previous year and projected to be performed for the coming year as part of the Annual Work Plan submitted to the USFS each year. Monitoring of riparian enhancement areas would be conducted to assess riparian vegetative trends in areas that have been planted. Riparian habitat photo points would be established and utilized annually to monitor trends over time. Monitoring results would be documented and summarized yearly in the Annual Work Plan.

Land Use and Mining

Land uses within the Project area would be changed to mining during the life of the proposed project or any of the action alternatives. Post-mining land uses designated by the USFS for the area would be established as a result of interim, concurrent and final reclamation within the area.

Monitoring

Reclamation activities would be monitored during implementation through the QA/QC program. Revegetation success would be determined by the methods described above under Vegetation.

Livestock Grazing

IMC proposes to work with the USFS and permittees to mitigate for changes affecting grazing allotments. Fences would continue to be constructed and maintained by IMC around the perimeter of the disturbance areas. Other grazing allotment fences would be constructed or relocated if required as a result of mining operations. IMC would construct new water developments designated by the USFS to mitigate loss or inability to use any water developments on affected open grazing allotments. Reclamation seed mixes would include plants that are used by livestock. Access would be provided to grazing permittees.

Monitoring

The livestock mitigation measures to be implemented with the proposed project would be monitored as part of the QA/QC program. IMC would report the mitigation measures implemented during the previous year and projected to be performed for the coming year as part of the Annual Work Plan submitted to the USFS each year.

Recreation and Public Access

During reclamation, USFS-designated roads would be reclaimed in a manner that would allow motorized access to and within the Project area. This measure would re-establish public access within the area closed during mining operations. IMC is considering the merits of establishing new public access routes elsewhere and would coordinate these efforts with the USFS. The establishment of new public access can be accomplished in many areas by improving existing exploration roads.

Monitoring

No monitoring of effects to public access or mitigation measures are proposed.

Socioeconomic Environment

No mitigation measures or monitoring programs for effects to the socioeconomic environment are proposed.

Visual Resources

All of the proposed disturbance areas are situated within an area that is classified with a Visual Quality Objective (VQO) of maximum modification. Under this category, human activities may dominate the characteristic landscape, with some limitations.

The waste rock dumps, haul roads and other mine components would be compatible with the surrounding terrain after reclamation. The flat portions of the waste rock dumps would have an undulating surface and piles of large boulders would be placed at scattered locations.

Monitoring

The visual resources mitigation measures to be implemented with the proposed project and the alternatives would be monitored as part of the QA/QC program.

Cultural Resources

Cultural resource surveys have been completed for the Project area. However, if new sites are discovered during operations, activities would cease in these areas until the site was evaluated and the area cleared for continued operations. IMC would restrict heavy equipment under its control to the analyzed disturbance areas for the alternative selected for implementation by the USFS. This measure would mitigate against additional surface disturbance and potential disturbance to any unidentified cultural resources.

Monitoring

The cultural resources mitigation measures to be implemented with the proposed project and the alternatives would be monitored as part of the QA/QC program.

2.7 Comparison of Alternatives

Effects to the physical, biological and socioeconomic environments would be incurred under all alternatives. One of the purposes of this FEIS is to display the differences in environmental effects among the alternatives. A summary of the effects of the alternatives in relation to identified issues is presented in Table 2.3 at the end of this chapter. Additional discussion of the effects associated with the alternatives are included in Chapter

4. Differences between alternatives are displayed quantitatively in Table 2.3, where possible. Qualitative analysis is provided where differences are not easily defined by quantitative measurement.

The fundamental differences among the alternatives are the use of 3H:1V waste rock dump slopes and underground mining of the New Deep ore body. Alternatives that include final reclamation to 3H:1V waste rock dump slopes were proposed with the intent of providing greater slope stability and greater revegetation potential. Underground mining of New Deep was proposed in two of the alternatives because it is a reasonably foreseeable future activity that warranted consideration and analysis. As indicated in Table 2.3 and discussed in the analysis in Chapter 4, use of underground mining methods in Alternative F would provide environmental benefits in relation to the other alternatives because there would be less disturbance associated with New Deep mining operations. However, costs of underground mining are greater and it results in less than full utilization of the mineral resource.

Environmental benefits of 3H:1V slopes are less easily quantified. The potential for revegetation would be greater on 3H:1V slopes than on angle of repose slopes, and mass stability would be greater. Additional benefits may be realized by other resources such as wildlife and vegetation resources. However, there would be greater surface disturbance associated with construction and reclamation of waste rock dumps to 3H:1V slopes and construction costs would be higher. All slopes under any alternative would meet minimum safety requirements.

The following sections describe the differences in the effects of the various alternatives in relation to the four focus issues. A discussion of a cost and benefit analysis for the project follows these sections.

Water Quality - Acid Rock Drainage

Evaluation of the acid generation potential of waste rock to be mined in the Saval, Steer and Burns Basin mine areas indicates that the waste rock dumps for these mine areas have a low potential to generate acid. The composition of the waste rock to be mined and placed in the dumps does not vary appreciably among alternatives. There are no substantive differences among alternatives in terms of potential to generate acid in the Saval, Steer and Burns Basin mine areas.

Acid-base accounting analyses of waste rock to be generated by open-pit mining of the New Deep deposit indicate that these rocks have a low to moderate potential to form acid. Samples of these rocks have been evaluated using kinetic testing techniques. Under Alternatives B, C, D, E, and G the New Deep deposit would be mined by open pit methods, exposing more waste rock to oxidizing conditions than Alternative F.

Although Alternative F would have less waste rock, the volume of acid-generating and neutralizing waste rock is not fully known. Therefore, the potential to generate acid would be determined during the waste rock evaluation program implemented during mining.

Waste Rock Dump Design for Stability

Waste rock dump designs under all action alternatives would have designed safety factors that are acceptable to the USFS. Waste rock dump slopes that are entirely 3H:1V from toe to crest under Alternatives D and E would have higher safety factors than dumps with angle of repose slopes.

Reclamation Potential - Revegetation

For the purposes of this analysis, reclamation potential is essentially equivalent to the acreage that would have growth medium applied and be seeded using proven reclamation techniques. Under this definition, alternatives with 3H:1V waste rock dump slopes (Alternatives C, D, and E) have higher revegetation potential than those alternatives (B, F, and G) with angle of repose slopes.

Mine Economics

Operational costs vary among Alternatives B, C, D, E, and G primarily in response to differences in the final configuration of the waste rock dumps and mining method. Under Alternatives C, D, and E, waste rock dump slopes would be pushed to 3H:1V during reclamation. Increased costs that would result, compared to Alternative B, are $2.13 million for Alternative C, $35 million for Alternative D, and $17 million for Alternative E. Alternative F would cost approximately $410,000 more than Alternative B due to higher costs associated with underground mining. Alternative G would cost approximately $200,000 more than Alternative B due to increased costs associated with mining the New Deep orebody with both underground and open pit mining methods.

Costs and Benefits

The relative costs and benefits of the various alternatives was requested during the public scoping process. For purposes of complying with NEPA, weighing adverse and beneficial effects of the various alternatives need not be displayed in a monetary cost-benefit analysis. However, members of the public specifically requested an analysis of the tradeoffs between increased costs and environmental benefits. Such tradeoffs cannot always be quantified. The relationship between increased costs and the design of the alternatives to respond to various physical environmental and socioeconomic issues is summarized below.

Costs of the various alternatives are displayed in Table 2.3 under the Mine Economics section. Under Alternative A, additional costs would include the loss of investment in infrastructure, exploration, and the opportunity costs of leaving minable ore in the ground. Alternative B is the most economic alternative, giving consideration to the costs involved in the mitigation measures described in Section 2.6. Increased costs for Alternatives C, D, and E result primarily from the creation of 3H:1V slopes on waste rock dumps and from the additional costs of hauling waste rock farther from the New Deep pit in Alternatives D and E. In addition, the configuration of the waste rock dump in Alternative D would make it difficult or impossible to access identified mineral resources west of the New Deep pit in the

future. Alternative F would cost more than Alternative B because of the increased costs of underground mining, and not as much ore would be recovered as under Alternative B. Alternative G would cost more than Alternative B because underground mining would be used first for concentrated ore bodies and open pit methods would be used later for the remaining and more dispersed ore reserves. Socioeconomic costs and benefits are also displayed in Table 2.3.

2.8 Preferred Alternative

The USFS's preferred alternative is Alternative C for the Burns Basin Expansion Area, Saval and Steer Operation Area; and Alternative F for the New Deep Area. IMC has confirmed by their studies to the USFS that it is economically and operationally feasible to use underground mining techniques for the New Deep ore body. Rationale for selection of this alternative as the preferred alternative as well as the identification of an environmentally preferred alternative is presented in the USFS Record of Decision attached to this FEIS.

Table 2.3
Alternative Comparison & Impacts Summary (by Issue)

Issue	Alternative A No Action	Alternative B Proposed Action	Alternative C	Alternative D	Alternative E	Alternative F	Alternative G
Focus Issue: Water Quality - ARD	Existing, approved operations would continue until completion. No ARD has been detected from existing operations.	Waste rock in the Saval, Steer & Burns Basin mine areas has low potential to generate acid. Waste rock in the New Deep mine area has a low to moderate potential to generate acid.	Similar to Alternative B	Similar to Alternative B	Similar to Alternative B	Similar to Alternative B	Similar to Alternative B
Focus Issue: Waste Rock Dump Design for Stability	Existing, approved operations would continue until completed	Dumps would have designed safety factors acceptable to USFS.	Similar to Alternative B. Dumps with 3H:1V slopes would have higher factors of safety than angle of repose slopes.	Similar to Alternative C	Similar to Alternative C	Similar to Alternative B	Similar to Alternative B
Focus Issue: Reclamation - Revegetation							
Total Disturbance Area	2,183 acres (existing, approved)	2,966 acres	3,099 acres	3,142 acres	2,952 acres	2,041 acres	3,013 acres
Revegetation Area	1,229 acres (existing, approved)	1,358 acres	1,468 acres	1,775 acres	1,503 acres	1,060 acres	1,403 acres
Reclamation & Revegetation methods	Existing, approved operations would continue until completed with reclamation plans as approved in previous documents.	The goal of revegetation efforts would be to re-establish a productive vegetative cover within two to five years. Seed mixtures would be approved by the USFS and would include a variety of grasses, forbs and shrubs. Species selection would be based on adaptability, diversity and potential for successional enhancement.					
Post Mining Land Uses	Post-mining land use would approximate overall pre-mining conditions in the Project area, but would not recreate pre-mining conditions due to changes in topography. Post-mining land uses would be a composite of uses including forage for livestock, wildlife habitat, recreation, public access, minerals exploration and development, and use as a functioning watershed.						
Focus Issue: Mine Economics (includes costs of mitigation)	Existing, approved operations are anticipated by IMC to decline in 1994 & totally cease by 1996.	In the range of alternatives, Alternative B is the most economical.	Alternative C would cost $2.13 million more than Alternative B.	Alternative D would cost $35 million more than Alternative B.	Alternative E would cost $17 million more than Alternative B.	Alternative F would cost $410,000 more than Alternative B, but would not recover as much ore.	Alternative G would cost $200,000 more than Alternative B.

Table 2.3, Continued
Alternative Comparison & Impacts Summary (by Issue)

Issue	Alternative A No Action	Alternative B Proposed Action	Alternative C	Alternative D	Alternative E	Alternative F	Alternative G
Wildlife: Mule deer habitat	Existing, approved operations would continue until completed. Off-site mitigation would be conducted in accordance with the existing MOU among IMC, the USFS and NDOW and the Mule Deer Habitat Improvement Plan designed to implement the MOU.	Off-site mitigation would continue under the MOU and the Mule Deer Habitat Improvement Plan					
Mule Deer - Winter Range (acres of potential habitat affected)	1,833 acres (existing and approved)	2,627 acres	2,698 acres	2,854 acres	2,618 acres	1,790 acres	2,666 acres
Mule Deer - Summer Range (acres of potential habitat affected)	55 acres (existing and approved)	300 acres	301 acres	319 acres	305 acres	253 acres	300 acres
Wildlife: Goshawk Effects to Nests	Existing, approved operations would continue until completed.	Nest 074 would be removed by the Steer pit and nests 127 and 128 would be covered by waste rock dumps. No other nests would be directly affected, but new disturbance would occur in the home range of nests 027, 037, 134, 135, and 136.	Same as Alternative B	Same as Alternative B	Same as Alternative B	Same as Alternative B	Same as Alternative B
Goshawks: Cumulative Short-term Effects (as percent of total "home range" area)	Alternative A effects are existing and approved.	The following information for Goshawk includes existing and proposed disturbances under each alternative for total cumulative disturbance.					
Nest 027	7.0%	11.8%	12.1%	11.9%	11.8%	12.1%	11.8%
Nest 037	6.4%	6.4%	6.4%	6.4%	6.4%	6.4%	6.4%
Nest 074	12.5%	42.1%	43.3%	45.3%	44.6%	39.7%	42.1%
Nest 127	13.1%	55.9%	56.9%	58.4%	55.7%	43.3%	56.4%
Nest 128	16.1%	57.7%	58.7%	60.7%	57.5%	44.6%	58.4%
Nest 134	10.9%	19.4%	19.9%	19.5%	19.4%	19.8%	19.4%
Nest 135	11.7%	19.0%	19.5%	19.0%	18.9%	19.4%	19.0%
Nest 136	11.9%	17.4%	17.9%	17.4%	17.3%	17.8%	17.4%
Wildlife: Sage Grouse Brooding Habitat (acres of potential habitat affected)	441 acres (existing and approved)	1,149 acres	1,196 acres	1,233 acres	1,051 acres	729 acres	1,178 acres

Table 2.3, Continued
Alternative Comparison & Impacts Summary (by Issue)

Issue	Alternative A No Action	Alternative B Proposed Action	Alternative C	Alternative D	Alternative E	Alternative F	Alternative G
Wildlife: Threatened, Endangered or Sensitive Animal Species	Existing, approved operations would continue until completed and as approved under previous NEPA documentation.	Endangered species: Impacts to bald eagles and peregrine falcons would be negligible. Bald eagles may occasionally migrate through the Project annually; peregrine falcons rarely pass through the area. Threatened species: There would be no additional impact to Lahontan cut throat trout. Candidate Species: Decreased flows and short-term increases in sedimentation could have some adverse impacts for potential redband trout habitat in Burns Creek. Sensitive Species: Long term loss of potential flammulated owl habitat exists under all action alternatives.					
Wildlife: Golden Eagles							
Number of Golden Eagle Nests Directly Affected	Existing, approved operations would continue.	0	0	0	0	0	0
Other Golden Eagle Nests	Existing, approved operations would continue.	Proposed new disturbance would not disturb the two nests within Jerritt Canyon. These nests, active during 1992 and 1993, are projected to continue to be occupied.	Same as Alternative B	Same as Alternative B	Same as Alternative B	Alternative F has the least likelihood of affecting golden eagle nests due to the greatly reduced surface disturbance in Jerritt Canyon.	Same as Alternative B
Wildlife: Upland Game Birds and Furbearers							
Direct Loss of Habitat Associated with Projected Area of Disturbance (acres)	2,183 acres (existing, approved)	2,559 acres	2,662 acres	2,744 acres	2,557 acres	1,777 acres	2,605 acres
Wildlife: Trout	Decreased flows and short term increases in sedimentation could have some adverse impacts to potential trout habitat in Burns Creek.						
Wetlands: (acres of impacted wetlands)	3.57 acres (existing, approved)	3.40 acres	3.67 acres	3.82 acres	3.64 acres	2.89 acres	3.40 acres
Vegetation: Diversity	Existing, approved operations would continue.	During the life of the Project, there would be a reduction in plant composition, age classes, heights and canopy densities within disturbed areas. Once reclamation activities are completed and vegetation becomes re-established, new community types consisting of a mixture of native and introduced grasses, forbs and shrubs would be created. Over time, first generation plantings of grasses, forbs and shrubs would mature and reproduce and invasion by plant species from adjacent undisturbed areas would occur.					
Vegetation: Threatened, Endangered and Sensitive Plant Species	No threatened, endangered, or sensitive plant species have been identified in the Project area and no effects to such plant species are anticipated as a result of the action alternatives.						

Table 2.3, Continued
Alternative Comparison & Impacts Summary (by Issue)

Issue	Alternative A No Action	Alternative B Proposed Action	Alternative C	Alternative D	Alternative E	Alternative F	Alternative G
Vegetation: Aspen fragmentation Disturbance by type of aspen (in acres)							
Mature Aspen	559 acres	623 acres	648 acres	641 acres	627 acres	613 acres	623 acres
Snowbank Aspen	24 acres	14 acres	14 acres	15 acres	14 acres	14 acres	14 acres
Grazing	Existing, approved mining operations would continue until completed.	63% reduction in animal months for Jerritt Canyon Cattle and Horse Allotment. No loss for Schmitt Creek Cattle and Horse Allotment.	Same as Alternative B	Same as Alternative B	Same as Alternative B	29% reduction in animal months for Jerritt Canyon Cattle and Horse Allotment. No loss for Schmitt Creek Cattle and Horse Allotment.	Same as Alternative B
Water Quality & Quantity: Potential for Water Impoundment	No water has been or is anticipated to be impounded by existing, approved operations	Impoundment of water in the Saval, Steer & Burns Basin pits is not expected. Water impoundment in the New Deep pit is possible. Pit inflow is anticipated between 100-300 gallons per minute during mining, but no active dewatering is currently anticipated. After mining, water impounded in the pit could be 140 feet deep with a 19 acre surface area.	Similar to Alternative B	Similar to Alternative B	Similar to Alternative B	Similar to Alternative B for the Saval, Steer & Burns Basin pits. Water flow into underground workings at New Deep are estimated at 100-150 gallons per minute. Water would be directed to sumps but no active dewatering program is currently anticipated. After mining, water would not flow out of underground workings to surface waters.	Similar to Alternative B
Water Quality: Potential Loss of Water Flow to the Surface at Niagara Spring & Van Norman Spring	Existing, approved operations would continue until completed.	No flow reductions are anticipated at Van Norman Springs. Flow reductions may be possible at Niagara Spring if there is a hydraulic connection to the New Deep pit area. Estimated inflows to New Deep pit are approximately three to eight percent of average flow at Niagara Spring.					
Water Quality & Quantity: Potential for Sedimentation: total post-mining annual sediment yield in excess (+) or below (-) pre-mining condition (in metric tons)							
Jerritt Creek (metric tons)	+400	-1040	-1040	-730	-1000	-50	-1040
Burns Creek (metric tons)	-260	-260	-200	-200	-200	-200	-260

Table 2.3, Continued
Alternative Comparison & Impacts Summary
(by Issue)

Issue	Alternative A No Action	Alternative B Proposed Action	Alternative C	Alternative D	Alternative E	Alternative F	Alternative G
(Note: Reductions in sediment yield in part reflect reductions in surface water runoff where runoff flows into pits.)							
Disturbance as percent of total watershed							
Jerritt Creek	17.5%	28.0%	28.9%	30.3%	28.0%	18.1%	28.6%
Burns Creek	12.5%	7.1%	7.8%	7.2%	7.0%	7.7%	7.1%
Post-mining changes to runoff in excess (+) or below (-) pre-mining conditions (in acre feet)							
Jerritt Creek (acre feet)	-90	-490	-490	-440	-560	-10	-490
Burns Creek (acre feet)	-520	-520	-520	-520	-520	-520	-520
Water Quality & Quantity: Quality of Surface & Ground Water	Existing, approved operations would continue until completion.	Impacts to water quality would primarily result from potential for acid rock drainages and sedimentation as described above.					
Recreation: Hunting & Fishing	Existing, areas closed for mine safety would remain closed until existing approved operations cease.	The area closed for public safety would be expanded to include proposed operation areas resulting in relocation of one gate on the Arana road and one on the Jerritt Creek road. Hunting opportunities outside of the closed area are not anticipated to change significantly from existing conditions. No mining operations are proposed for areas that support reproducing fish populations.					
Visual Resources	Existing, approved operations would continue to completion resulting in modifications to pre-mining land forms	Operations would result in major modifications to existing land forms but would be in conformance with the maximum modification VQO classification.	Similar to Alternative B	Similar to Alternative B	Similar to Alternative B	Similar to Alternative B for the changes associated with the Saval, Steer & Burns Basin operations. Changes from underground mining in New Deep would be less than those of open pit & waste rock dumps in Alternative B.	Similar to Alternative B
Cultural: Impacts to Sites Eligible for the NRHP and/or to unevaluated sites.	0	0	0	0	0	0	0

Table 2.3, Continued
Alternative Comparison & Impacts Summary (by Issue)

Issue	Alternative A No Action	Alternative B Proposed Action	Alternative C	Alternative D	Alternative E	Alternative F	Alternative G
Socioeconomics:							
Employment: (New Positions)	0	175	175	200	200	155	270
Effects on Elko County:							
Population	Potential decrease due to job losses. (up to 1,350 jobs)	Less than a two percent increase would result from people moving into Elko County due to expanded mining job and service sector job opportunities.					
Housing	Potential for reduced property values if displaced workers move out of Elko County.	An estimated 9 to 15 temporary units and 136 to 210 permanent units could be required for in-migrating mine families and service sector families. The rental market would continue to be tight and new mobile and single-family homes would likely provide needed housing over time.					
Schools	An immediate loss of $3.7 million in revenues to the Elko County School District could result due to loss of students.	New students would likely be enrolled in public schools in Elko and Spring Creek beginning late 1994 and early 1995. The greatest impacts to schools would occur under Alternatives D, E and G.					
Potential effects to tax structure & revenues to the County	Potential for significant negative effects to the County's financial resources, due to loss of tax revenues. IMC is the largest property tax payer in the County.	The County's three most important sources of revenue are sales and use taxes, property taxes and net proceeds taxes. Revenues from sales and use taxes would be expected to increase under all action alternatives. However, because of reduced net proceeds in the 1992-1993 fiscal year, IMC has agreed to take a credit on future net proceeds tax payments in lieu of requesting an $800,000 refund from the county and state (net proceeds taxes are paid one year in advance). Compared to Alternative B, all action alternatives would result in added costs, resulting in reductions to net proceeds tax revenues as indicated below.					
		Potential Reduction in Net Proceeds Tax Revenues compared to Alternative B.					
		0 (Baseline)	($106,500)	($1,756,500)	($887,500)	($20,500)	($10,000)
Community Stability-Length of Operations: year of completion for mine operation & reclamation activities	1996	2005	2005	2006	2006	2004	2005
Air Quality:							
Fugitive Dust	Existing, approved operations would continue until completion.	Particulate emissions would continue to result from mining operations but would not result in any substantial impacts to air quality with appropriate mitigation measures.	Similar to Alternative B	Similar to Alternative B	Similar to Alternative B	Similar to Alternative B for Saval, Steer, & Burns Basin pits. Underground mining in New Deep would result in lower emissions than open pit mining in Alternative B.	Similar to Alternative B.

Chapter 3

Affected Environment

Photo Description: View of existing drill and blast operations looking south to the Saval and Steer Canyons (Fall 1992).

CHAPTER 3

AFFECTED ENVIRONMENT

3.0 AFFECTED ENVIRONMENT

3.1 Introduction

This chapter describes the portions of the physical, biological, social and economic environments that would affect or may be affected by the implementation of any of the alternatives for the Jerritt Canyon Mine Expansion, referred to as the Project. This chapter presents the existing conditions as a baseline for the analysis of potential impacts that are examined in Chapter 4.

The Project area (shown on Map 1.2) has been the subject of numerous studies since 1979. The Jerritt Canyon Project was initiated after the completion of the Jerritt Canyon Project Gold Mine and Mill EIS in 1980. Data collected for this project and subsequent mining operations and exploration activities over the past thirteen years form a comprehensive data base that is incorporated by reference into this document. A list of documents that are incorporated by reference is included in the bibliography.

A substantial amount of additional information was gathered to update the existing information base for the Jerritt Canyon Mine Expansion EIS. Field studies, literature surveys and personal interviews were conducted by an interdisciplinary group of resource specialists including wildlife biologists, hydrologists, botanists, archaeologists, geologists, engineers and socioeconomists. Detailed information was collected within the Project area. Additional updated information was collected in the general study area, a 44,000 acre area surrounding the Project area (See Map 1.2).

Resource analysis areas vary by resource and are described in this chapter according to resource topics under the general categories of physical, biological, and socioeconomic environments, land use, visual and cultural resources. Many of the existing resources are described according to criteria outlined in the Independence Range Cumulative Effects Analysis (CEA) Technical Guide. The CEA model was developed by the USFS, NDOW, and three mining companies to provide a standardized approach for analyzing direct and cumulative impacts in the Independence Mountain Range. The CEA Technical Guide lays out the procedures, analytical models, and data base to be used in evaluating the cumulative effects of mining proposals in combination with the effects of past and foreseeable future development. The CEA model defines the geographic area of analysis, or analysis "province," for a variety of resources including wildlife species, visual quality, recreation, and cultural resources. The CEA model also identifies what will be used to measure impacts for each resource and identifies "thresholds of concern" (TOCs) to determine the significance of impacts. The TOCs, provinces, and other analytical procedures were

developed by USFS and NDOW resource specialists in consultation with environmental staff from the mining companies. In this FEIS, existing resources are described in relation to TOCs and other CEA criteria in order to provide a basis of comparison for the potential impacts described in Chapter 4.

The CEA model utilizes a computerized Geographic Information System (GIS) data base to track and measure changes to each resource within a province. This data base consists of hundreds of computerized map "layers" that can be selectively integrated and statistically interpreted to provide quantitative analysis of existing conditions and potential impacts associated with each alternative. The quantitative analysis of existing conditions is included in this chapter. The quantitative analysis of impacts is detailed in Chapter 4 and is summarized in Table 2.3.

3.2 Physical Environment

Location and Topography

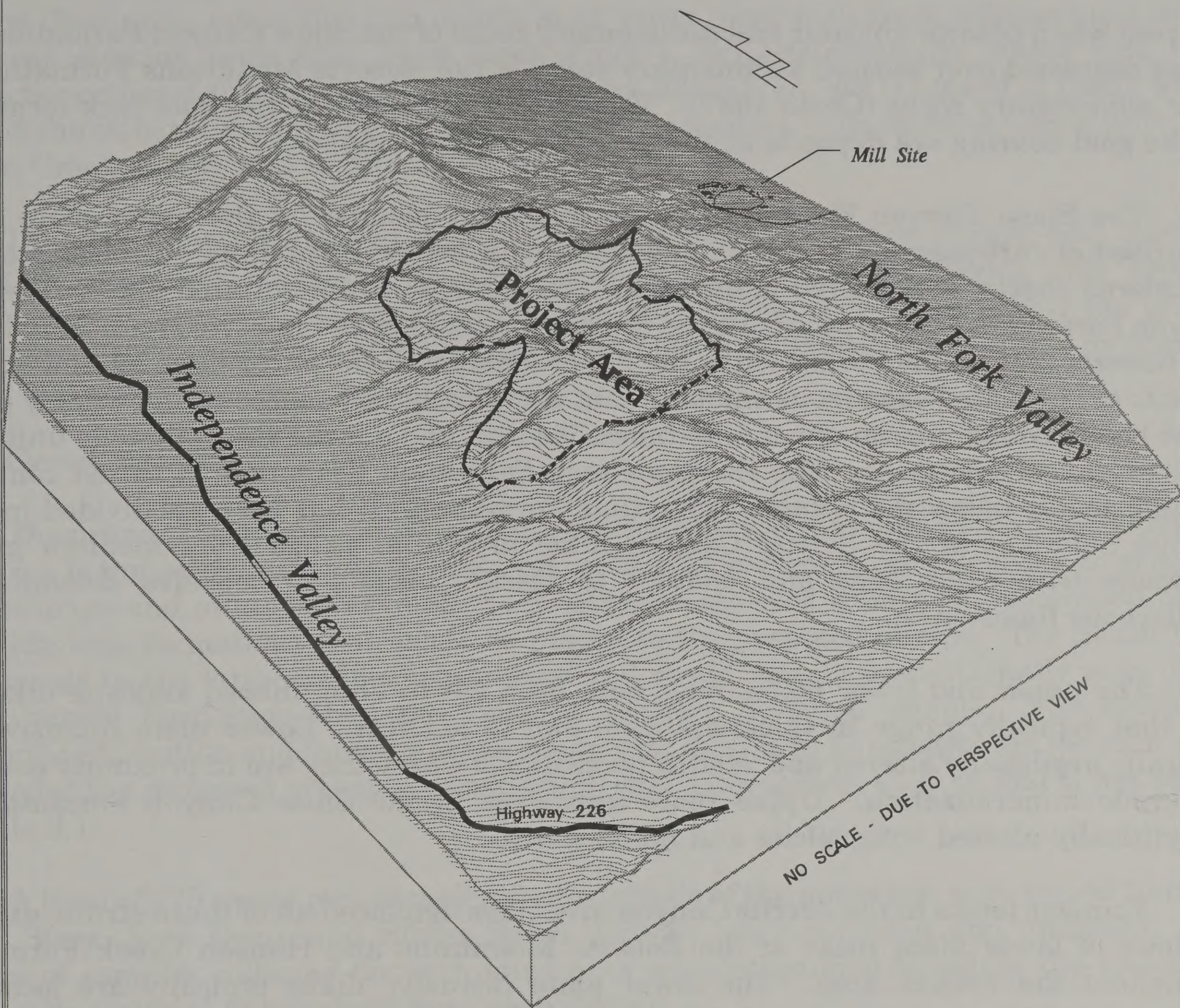
The analysis area for topography is the Project area. The Project area includes all or portions of Sections 28, 32, 33, 34 and 35, Township 41 North, Range 53 East and Sections 1, 2, 3, 4, 5, 8, 9, 10, 11, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23 and 28, Township 40 North, Range 53 East Mount Diablo Meridian. The total Project area comprises 10,849 acres of which 1,272 acres are private inholdings within the Humboldt National Forest as shown on Map 1.2.

The Project area is located on the western slope of the Independence Mountain Range. The Independence Mountains are flanked by the Independence Valley to the west and the North Fork Valley to the east (Map 3.1). Topography ranges from moderate slopes to sheer cliffs in Burns Basin and Steer Canyon, with deeply dissected canyons, rolling ridges and shallow draws. Foothills and valleys along the west margins of the range slope down to the nearly flat Independence Valley basin. Elevations in the Project area range from 6,100 ft. to 8,500 ft. Existing topography within the Project area includes features that are the result of disturbance by mining activities, including haul roads, pits and waste rock dumps (See Map 2.1).

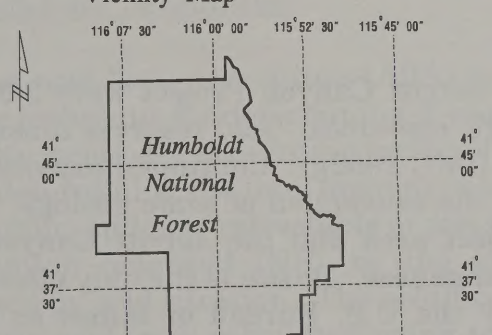
The drainages that dissect the mountain slopes in the Project area include Jerritt, Steer, Saval, Burns and Mill Creeks. Jerritt, Burns and Mill Creeks run generally to the west. Saval and Steer drain primarily north-facing slopes and are contributory drainages to Jerritt Creek.

Geology

The Independence Range was formed during Basin and Range faulting that created the steep, block-faulted mountain range and uplifted the terrain in the Jerritt Canyon area (Birak and Hawkins 1984). The rocks exposed by erosion in the Jerritt Canyon area consist of two distinct assemblages of sedimentary rocks that occur in the upper plate and lower plate of the Roberts Mountains Thrust. Movement on the Roberts Mountains Thrust



Vicinity Map



Three Dimensional View of Independence Mountain Range

The shaded area within the Humboldt National Forest Vicinity Map represents the extent of the area shown in the 3-D surface map (above).

Data source: USGS Digital Elevation Models

Map 3.1

11/16/93

occurred when oceanic volcanic and sedimentary rocks of the Snow Canyon Formation were thrust eastward over basinal sedimentary rocks of the Roberts Mountains Formation and older sedimentary rocks (Coats 1987). The lower plate contains the host rock formations for the gold bearing ore deposits at the Jerritt Canyon Complex.

The Snow Canyon Formation is the dominant member of the upper plate and is comprised of carbonaceous siltstone and shale with lesser amounts of dolomitic siltstone, varicolored cherts, and altered mafic lavas (greenstones) and associated dikes. The Snow Canyon Formation is separated from the underlying rocks by the Roberts Mountains Thrust. The Roberts Mountains Formation is the upper member of the lower plate assemblage and consists of laminated calcareous siltstone that is typically carbonaceous and weakly pyritic. It has been divided into an upper silty limestone unit and a lower limy siltstone unit in the Jerritt Canyon mine area. The Hanson Creek Formation lies either in thrust contact or disconformably below the Roberts Mountains Formation. It has been subdivided into five distinct subunits in the Jerritt Canyon mine area that range from medium grained limestone with chert beds and nodules to thickly bedded or massive dolomitic and argillaceous limestones.

The upper and lower plates have both been cut by thin altered andesite dikes and sills that typically range in thickness from two to ten feet. Lower plate intrusives are generally argillically altered and pyritic, particularly where they are in proximity to or host low grade mineralization. Upper plate intrusives in the Snow Canyon Formation are propylitically altered with calcite and minor pyrite.

Younger faults in the Jerritt Canyon area have displaced all of these strata, exposing windows of lower plate rocks of the Roberts Mountains and Hanson Creek Formations throughout the Project area. The lower plate intrusive dikes typically are located in structures, which also served as fluid paths for mineralizing solutions.

Mineral Resources

The 1992 year-end gold reserves for the Jerritt Canyon Project were 3.66 million minable ounces, with 8.8 million ounces in geologic resources. Gold reserves consist of both oxidized ores and unoxidized carbonaceous ores (IMC 1992g). Continued exploration may result in the discovery of additional reserves or the conversion of some geologic resources to reserves. Other minerals found in the Project area and the Jerritt Canyon district include antimony, barite, silver, mercury and manganese. Barite is the only other mineral identified in the vicinity of the Project area by the U.S. Bureau of Mines as having a potential economic value (Schmauch 1992).

Gold mineralization in the Saval, Steer, New Deep and Burns Basin mine areas occurs at the intersection of high angle faults with structurally and lithologically permeable zones. The resulting ore bodies are typically tabular in form and concordant with bedding or located along high and low angle faults. The host rocks for mineralization vary throughout the district. The Saval and Steer ore bodies are hosted in unit 3 of the Hanson Creek Formation near its contact with unit 4 and in the Roberts Mountains Formation. In

the New Deep area, mineralization occurs in all lower plate rock types adjacent to a major northwest striking fault (the "New Deep Fault"), but preferentially where this fault intersects northeast trending faults. In the Burns Basin area, ore is hosted in faults where they cut the Roberts Mountains Formation near the contact with Hanson Creek unit 1, in Hanson Creek unit 3, and in altered dikes.

The gold mineralization at Jerritt Canyon is disseminated in nature, and open pit mining methods are currently the most economic means of recovering this type of mineralization. Underground mining methods are feasible only when higher ore grades occur in localized zones that are deeply buried and not economically recoverable by open pit mining methods.

Geochemistry

The primary issue associated with the geochemistry of the rocks in the Jerritt Canyon mine area is the potential for waste rock, pit walls, and low grade ore stockpiles to generate acid drainage and affect water quality. Existing waste rock dumps are composed of the same lithologic formations that would be placed in the proposed dumps. The South Deep dump would be the largest dump constructed and would contain proportionally more of the Snow Canyon Formation than the existing or other proposed dumps. The estimated lithologic composition and tonnage of the waste rock dumps to be constructed for each mine area under the proposed action (Alternative B) and Alternatives C, D, E and G are shown in Table 3.1.

A total of 375 waste rock samples characteristic of the materials to be mined from the Saval, Steer, New Deep, and Burns Basin deposits were collected and analyzed. The number of samples collected for each mine area was determined based on the amount of waste rock material to be mined from each deposit.

<u>Acid-Base Accounting</u>

The acid-base accounting (ABA) procedure is a geochemical static test used as a screening technique for determining if waste rock has the potential to generate or consume acid. Static acid-base accounting methods utilized involved grinding the samples to a small size and determining the total amount of sulfur and the sulfur forms present (pyritic sulfur, sulfate sulfur, and non-extractable or residual sulfur) by acid and hot water extraction. The neutralization potential (NP), or the ability of the material to neutralize acid, was determined by acid titration. The acidification potential (AP), or the ability of the material to generate acid, was calculated using total sulfur values (which is a more conservative prediction of acid-forming potential compared to using the pyritic sulfur values). This calculation assumes that all the sulfur present in the sample can be converted to sulfuric acid. Acid generation tests therefore do not measure acid generation, but rather they estimate the theoretical limit of acid generation, and thus are conservative in nature.

The potential for the waste rock in the New Deep, Saval, Steer, and Burns Basin mine areas to generate acid was evaluated using the ratio of NP to AP. Under this

Table 3.1
Summary of Acid - Base Accounting for Saval, Steer, New Deep and Burns Basin Alternatives B, C, D, E and G (All Acidification Potential Values Calculated with Total Sulfur)

MINE AREA	Percent of Rock Type In Dump[1]	Million Tons Of Waste	Total Number Of Samples	Range of NP/AP Values	Average NP/AP[2,3]	NP/AP <1	NP/AP >1 and <3
NEW DEEP (OPEN PIT)							
Snow Canyon	73.2	386.2	188	0.4 - 1475.2	28.7	9	37
Roberts Mountains	18.8	99.2	58	0.7 - 126.5	24.6	2	2
Hanson Creek I	0.5	2.6	6	4.1 - 113.6	55.3	0	0
Hanson Creek II	0.6	3.2	8	0.1 - 196.6	79.1	1	0
Hanson Creek III	0.6	3.2	7	7.0 - 51.2	36.3	0	0
Hanson Creek IV	1.6	8.4	11	0.8 - 245.8	71.2	1	1
Upper Plate Intrusives	3.0	15.8	8	4.1 - 45.9	21.4	0	0
Lower Plate Intrusives	1.6	8.4	5	0.0 - 4.8	1.3	4	0
TOTAL	99.9	527.0	291	Total Weighted Average	27.4		
SAVAL/STEER							
Snow Canyon	0.8	3.7	8	6.5 - 160.4	67.4	0	0
Roberts Mountains	55.6	257.5	22	1.5 - 1,452.8	165.3	0	1
Hanson Creek I	3.3	15.3	2	30.4 - 40.5	35.5	0	0
Hanson Creek II	2.4	11.1	4	2.7 - 1,155.5	363.3	0	1
Hanson Creek III	27.0	125.0	17	4.4 - 124.2	31.7	0	0
Hanson Creek IV	5.0	23.2	3	10.9 - 451.2	159.4	0	0
Eureka Quartzite	5.8	26.9	4	9.1 - 182.4	94.2	0	0
Lower Plate Intrusives	<1.0	0.5	4	1.1 - 2.3	1.7	0	4
Alluvium	<1.0	0.5	8	14.2 - 1,075.2	373.8	0	0
TOTAL	101.9	463.6	72	Total Weighted Average	125.7		
BURNS BASIN							
Snow Canyon	0.1	0.1	1	#	5.2	0	0
Roberts Mountains	28.3	26.5	2	15.9 - 139.7	77.8	0	0
Hanson Creek I	5.2	4.9	1	#	19.0	0	0
Hanson Creek II	3.5	3.3	1	#	42.6	0	0
Hanson Creek III	55.0	51.5	3	119.0 - 2,681.6	1,052.4	0	0
Hanson Creek IV	7.8	7.3	2	39.9 - 79.9	59.9	0	0
Lower Plate Intrusives	<0.1	0.1	2	9.3 - 64.3	8.0	0	0
TOTAL	99.9	93.6	12	Total Weighted Average	608		

Source: Westec, February 11, 1994.

Note: [1] Calculated for dump volumes in Alternative B - the Proposed Action
[2] Neutralization Potential divided by Acidification Potential
[3] Reported in tons of $CaCO_3$/1,000 tons rock
Insufficient number of samples to report a range of values.

evaluation method, if the NP/AP ratio is less than one, the material is considered potentially acid generating, if it is greater than 3, the material is considered non-acid generating, and if it is between 1:1 and 3:1, it falls into a "zone of uncertainty" (Broughton, Chambers and Robertson 1992). For the purposes of this study, samples with an NP/AP value less than 3 are referred to as potentially acid-generating. The NP/AP results from samples collected for the mine expansion are presented in Table 3.1.

If it is determined, based on the interpretation of static test results, that a sample has the potential to generate acid, kinetic testing (i.e. humidity cells or column leaching) is initiated on a representative number of waste rock samples. Kinetic testing provides an indication of whether acid would be generated and the rate of acid generation under simulated field conditions.

The NP/AP analysis results indicate that there is a low potential for acid generation and subsequent acid drainage from waste rock derived from the Saval and Steer pits and expansion of the Burns Basin pit. The low acid generation potential is indicated by the minimal number of samples with NP/AP ratios less than three and the high average NP/AP values. The NP/AP results from some samples of intrusive dikes in the Saval and Steer mine area and the Burns Basin mine area indicate that they would produce acid, but they comprise less than one percent of the waste rock that would be mined.

Based on initial static acid-base accounting analysis data for the New Deep waste rock, there is low potential for acid to be generated by the Roberts Mountains and Hanson Creek Formations and a moderate potential for the Snow Canyon Formation and intrusive rocks to generate acid. Four of the five samples from lower plate intrusives in the New Deep mine area have NP/AP values less than one and may potentially produce acid. NP/AP values less than three were reported for 46 of the 188 samples analyzed from the Snow Canyon Formation and are classified as potentially acid producing.

The acid-base accounting results were also interpreted using the method recommended by the NDEP (NDEP 1990). Under this method, materials are considered potentially acid-forming if the acidification potential (calculated only with total sulfur for this analysis) is less than 20 percent greater than the neutralization potential. Twenty-one samples out of the 291 analyzed in the New Deep area, none of the 12 samples analyzed in the Burns Basin area, and one sample from the 72 analyzed in the Saval and Steer area did not have 20 percent excess neutralization potential.

Twenty-seven samples of waste from the Saval, Steer, New Deep and Burns Basin mine areas were selected for kinetic testing using humidity cells. The samples were analyzed for 20 to 30 weeks by a modified humidity procedure (Schafer 1994). Samples for kinetic testing were selected based upon static test results, and represent the worst 5 to 10 percent of all materials analyzed. Three Saval/Steer lower plate intrusives, two Burns Basin lower plate intrusives, four New Deep lower plate intrusives, 12 Snow Canyon Formations, two Roberts Mountain Formations, and one each of Hanson Creek units I through IV were analyzed. Of the Roberts Mountains and Hanson Creek Formation samples, all but three were silicified to jasperiod.

Table 3.2
Mine Waste Characterization
Jerritt Canyon Mine Expansion Project

Summary of Static and Humidity Cell Results			Humidity Cell Data			Static Test Data				
Sample Number	**Formation**	**Lithology**	**Risk Class**	**pH (avg)#**	**SO4 (mg/kg)#**	**Totals %**	**NP * (T. CaCO3)**	**AP * (T. CaCO3)**	**ABA *(1)**	**NP/AP * (2)**
New Deep Mine Area										
GH-866:340-345 (m)	Osc	Silicified pyritic mudstone	3	6.50	175	12.00	130.0	359.4	-229.4	0.4
GR-259A:40-45	Osc	Siltstone/mudstone/chert	1	7.50	22	0.37	65.0	10.9	54.1	5.9
GR-228:35-40	Osc	Mudstone/siltstone/chert	1	7.60	14	0.75	6.0	19.7	-13.7	0.3
GR-259A:75-80	Osc	Siltstone/mudstone/chert	2	7.30	47	1.20	82.0	31.6	50.4	2.6
GH-896:190-195	Osc	Mudshale/chert	2	6.80	34	3.44	119.0	102.5	16.5	1.2
GR-260:120-125	Osc	Mudshale/chert	2	7.50	40	1.66	76.0	47.3	28.8	1.6
GH-910:50-60 (m)	Osc	Siltstone/mudstone	2	7.70	71	2.38	71.0	69.7	1.3	1.0
GR-267:40-45	Osc	Siltstone	3	4.90	68	1.60	35.0	40.6	-5.6	0.9
GR-237:85-90	Osc	Siltstone/chert	1	7.70	20	0.85	40.0	24.7	15.3	1.6
GR-253:50-55	Osc	Chert/siltstone	1	7.70	21	0.54	17.0	15.9	1.1	1.1
GR-249:190-195	Osc	Siltstone/mudstone	4	4.30	202	4.13	117.0	105.0	12.0	1.1
GR-268:785-790	Osc	Siltstone/mudstone	4	2.70	1,657	4.56	196.0	137.8	58.2	1.4
GR-257:790-795 (s)	DSrm	Jasperoid	1	6.40	2	0.10	15.0	3.1	11.9	4.8
GR-252:1140-1145	DSrm	Siltstone	1	8.20	9	0.01	763.0	0.3	762.7	2,441.6
GH-892:240-245 (s)	SOhc1	Jasperoid/chert	1	7.00	0	0.01	13.0	0.3	12.7	41.6
GR-317:665-670 (s,m)	SOhc2/3	Jasperoid/barite	2	7.60	38	5.67	18.0	41.9	-23.9	0.4
GH-857B:455-465 (s)	SOhc3	Jasperoid/chert	1	7.50	2	0.02	11.0	0.3	10.7	35.2
GR-251:960-965	SOhc4	Chert/decalcified limestone	3	4.90	51	0.67	21.0	18.8	2.3	1.1

Table 3.2
Mine Waste Characterization
Jerritt Canyon Mine Expansion Project

Summary of Static and Humidity Cell Results			Humidity Cell Data			Static Test Data				
Sample Number	**Formation**	**Lithology**	**Risk Class**	**pH (avg)#**	**SO4 (mg/kg)#**	**Totals %**	**NP * (T. CaCO3)**	**AP * (T. CaCO3)**	**ABA *(1)**	**NP/AP * (2)**
GR-51:835-840 (s)	Intrusive	Argillized pyritic intrusive	5	2.30	1,310	11.70	2.0	353.1	-351.1	0.0
GR-138:855-860	Intrusive	Argillized pyritic intrusive	4	4.20	168	8.86	13.0	245.0	-232.0	0.1
GR-244:1265-1270	Intrusive	Argillized pyritic intrusive	3	7.40	291	12.50	153.0	359.4	-206.4	0.4
GR-220:930-935	Intrusive	Argillized pyritic intrusive	3	8.10	183	7.44	214.0	232.5	-18.5	0.9
Burns Basin Mine Area										
BB-13	Intrusive	Argillized pyritic intrusive	5	2.80	374	2.11	3.0	58.4	-55.4	0.1
BB-1993A	Intrusive	Argillized pyritic intrusive	5	2.90	367	3.64	13.0	89.7	-76.7	0.1
Saval/Steer Mine Area										
ST-581:105-110	Intrusive	Oxidized argillized intrusive	1	7.91	3	0.01	10.0	0.3	9.7	32.0
SC1011A:290-295	Intrusive	Oxidized argillized intrusive	1	8.40	3	0.01	413.0	0.0	412.7	1,321.6
SC1020:5-10	Intrusive	Oxidized argillized intrusive	1	9.70	2	0.01	292.0	0.3	291.7	934.4

* tons of CaCO3 equivalent per 1000 tons of material
*(1) Neutralization Potential Minus Acid Generating Potential
*(2) Neutralization Potential/Acid Generating Potential
\# = average solution value in week 16 to 20

HUMIDITY CELL RISK CLASS: (Schafer, 1994)
Class 1: Low Risk - non acid-forming
Class 2: Low Risk - non-acid but moderate sulfate release
Class 3: Moderate Risk - non-acid with high sulfate
Class 4: High Risk - initially neutral becoming acid
Class 5: High Risk - acid from inception

The results of the kinetic testing program are summarized in Table 3.2. The samples were grouped into five low to high risk categories (categories 1 to 5) based upon the change in solution pH during the 20 to 30 weeks of leaching, the rate of dissolved sulfate release, and the alkalinity and acidity values of the humidity cell leachate. Unoxidized lower plate intrusives were the most reactive of the samples tested due to their relatively high sulfur content and low neutralizing capabilities. Six of the nine intrusives fell into the moderate to high risk categories. Two of the 12 samples of Snow Canyon fell into the moderate to high risk categories and two fell into the moderate risk category. All of the jasperiod samples were classified as low risk, and one sample of Hanson Creek unit IV chert and decalcified limestone had a moderate risk of forming acid.

The kinetic testing was conducted to correlate the static acid-base accounting results to potential acid production. Threshold values of percent sulfur and NP/AP ratios were established for delineating potentially acid forming (risk categories 3, 4, and 5) and non-acid producing (risk categories 1 or 2) waste rock.

Based on the results of static testing and humidity cell results, there is a low potential for acid generation and subsequent acid-mine drainage from waste rock derived from the Roberts Mountain and Hanson Creek Formations. The low acid generation potential for these rock types is indicated by the minimal number of samples with NP/AP ratios less than three and the high average NP/AP values. One sample of decalcified limestone from the Hanson Creek Formation had a moderate potential to generate acid. However, decalcified limestone would not be volumetrically significant in the waste rock dumps to be developed in the Saval, Steer, New Deep, and Burns Basin mine areas.

Static acid-base accounting analysis data and kinetic test results indicate that the Snow Canyon Formation had a moderate potential to generate acid. Humidity cell results indicate that four of the twelve samples of Snow Canyon Formation that were analyzed had moderate to high potential to generate acid. These samples had a total sulfur content greater than one percent and NP/AP ratios less than 1.3. Based on these threshold values established through the kinetic testing program, it was determined that approximately five percent of the Snow Canyon waste is acid-generating.

Most of the lower plate intrusive that is unoxidized and strongly altered to clay is acid-forming. Four of the eleven samples of this rock type had NP/AP ratios less than one and four had ratios greater than one and less than three. All of the samples of unoxidized lower plate intrusive that were analyzed in humidity cells were classified as moderate to high risk of forming acid. The lower plate intrusive would make up less than two percent of the waste rock in the proposed waste rock dumps.

Trace Metal Mobilization

The potential for the waste rock to release trace elements was evaluated by the meteoric water mobility procedure (MWMP). This test was developed by the NDEP to determine if a material has the potential to release trace elements as a result of physical and chemical interaction with meteoric water (infiltrating rain water). It involves agitating

a mixture of waste rock and synthetic meteoric water (pH 5.5 to 6.0) for twenty-four hours and analyzing the water to determine which constituents are dissolved from the waste rock.

At the present time, there are no state or federal regulatory standards or limits for meteoric water mobility extracts. The NDEP recommends comparing meteoric water mobility results to the primary and secondary drinking water standards (NDEP Guidance dated November 2, 1990). Benefication wastes for which the meteoric water mobility extract exhibits a concentration less than 10 times the drinking water standard are considered benign (NDEP Guidance dated November 2, 1990). The results of the Saval, Steer, Burns Basin and New Deep waste rock meteoric water mobility procedure indicate that although several samples had slightly elevated arsenic, selenium, nitrate, and sulfate concentrations, the results are all less than 10 times the respective drinking water standard and are considered benign.

Geotechnical Considerations

Geotechnical considerations are primarily associated with waste rock dump stability. Dump stability factors include: 1) earthquake motions (seismicity); 2) the existence of unstable ground as evidenced by landslides or other movement features; 3) terrain steepness; 4) the clay content of foundation soils; 5) saturated foundation soils and springs; 6) final dump slope steepness; 7) dump material properties; and 8) vegetation within the waste rock dump area. A hazard analysis addressing each of these items was prepared for the waste rock dump sites. The following is a summary of the conditions examined in this analysis.

<u>Seismicity</u>

The Project area is located on the northern edge of the Basin and Range Province. This region experiences moderately high rates of tectonic and seismic activity but is located near the boundary of relatively stable areas in northern Nevada and less active regions to the north. The mine expansion area is located in Seismic Zone 2, as defined by the Soil Conservation Service (Kennedy/Jenks Consultants 1993d). A horizontal earthquake force of 0.10 g is the minimum design force for this seismic zone. This corresponds to an estimated return period of 250 years or the magnitude of the earthquake that may occur once every 250 years (Knight Piesold and Co. 1991).

<u>Landslides</u>

Aerial photographs and field observations by IMC geologists were used to determine if any landslides occur within the areas to be disturbed by any of the action alternatives (IMC 1993c). One small inactive landslide less than an acre in size occurs in the headwaters of the North Fork of Jerritt Creek, but would not be affected by the mine expansion activities (IMC 1993c). No other features indicative of natural instability have been identified within the areas proposed for disturbance.

Terrain Steepness

The GIS was used to classify the terrain within the Project area into several slope steepness categories. The natural topography slopes range from moderate slopes to sheer cliffs associated with rock outcrops. The drainage bottoms in the waste rock dump sites have slopes less than 30 percent. Side slopes above the drainages are generally steeper than 40 percent. It is assumed that foundation slopes steeper than 30 percent along a cross-section through an angle of repose slope can be a hazard relative to base sliding.

Foundation Soils

The soils of the Project area were classified and mapped during a soil survey conducted in 1992. The clay content and thickness of the soils are discussed in the Soils Technical Report and summarized in the soils section in Chapter 3.

Measurements of depths to bedrock indicate that the soils in the Project area are generally from two to four feet deep, but locally are as deep as 80 inches in drainages. The soils generally are sandy and gravelly silts. Soils with high clay contents are limited in extent and have only been mapped as a narrow band along Jerritt Creek. Silty clay loams range in thickness up to 60 inches.

Clays can have relatively low shear strength, can develop high pore pressures during dumping and can have relatively high consolidation characteristics, if saturated. The hazard increases as the thickness of the clay layer increases.

Saturated Foundation Soils and Springs

A survey for springs and seeps was conducted within the Project area during 1993. This survey identified 23 springs and 8 seeps in the Project area, as described in the groundwater section in Chapter 3. Most of the springs and seeps are less than 0.1 acre in size and many flow only in direct response to snowmelt during the spring and early summer months.

Riparian areas, springs or seeps can indicate the location of saturated foundation soils which could develop high pore pressures during dumping or cause other stability concerns. No areas of perennial snow accumulation occur within the waste rock dump sites proposed under any of the action alternatives.

Vegetation

The vegetation types occurring within the Project area were mapped during field surveys conducted between 1986 and 1993, as described under the vegetation section in Chapter 3. These surveys indicate that sagebrush/grasslands are the dominant community type, followed by mature aspen and north-facing mountain brush. Mature aspen typically occur on north facing slopes in the drainage bottoms. North-facing mountain brush

community type is normally found as discontinuous patches located on steep slopes with a northerly aspect.

Dumping on top of dense vegetation ground cover can create potential sliding surfaces beneath slopes or clog the base drainage of the dumps.

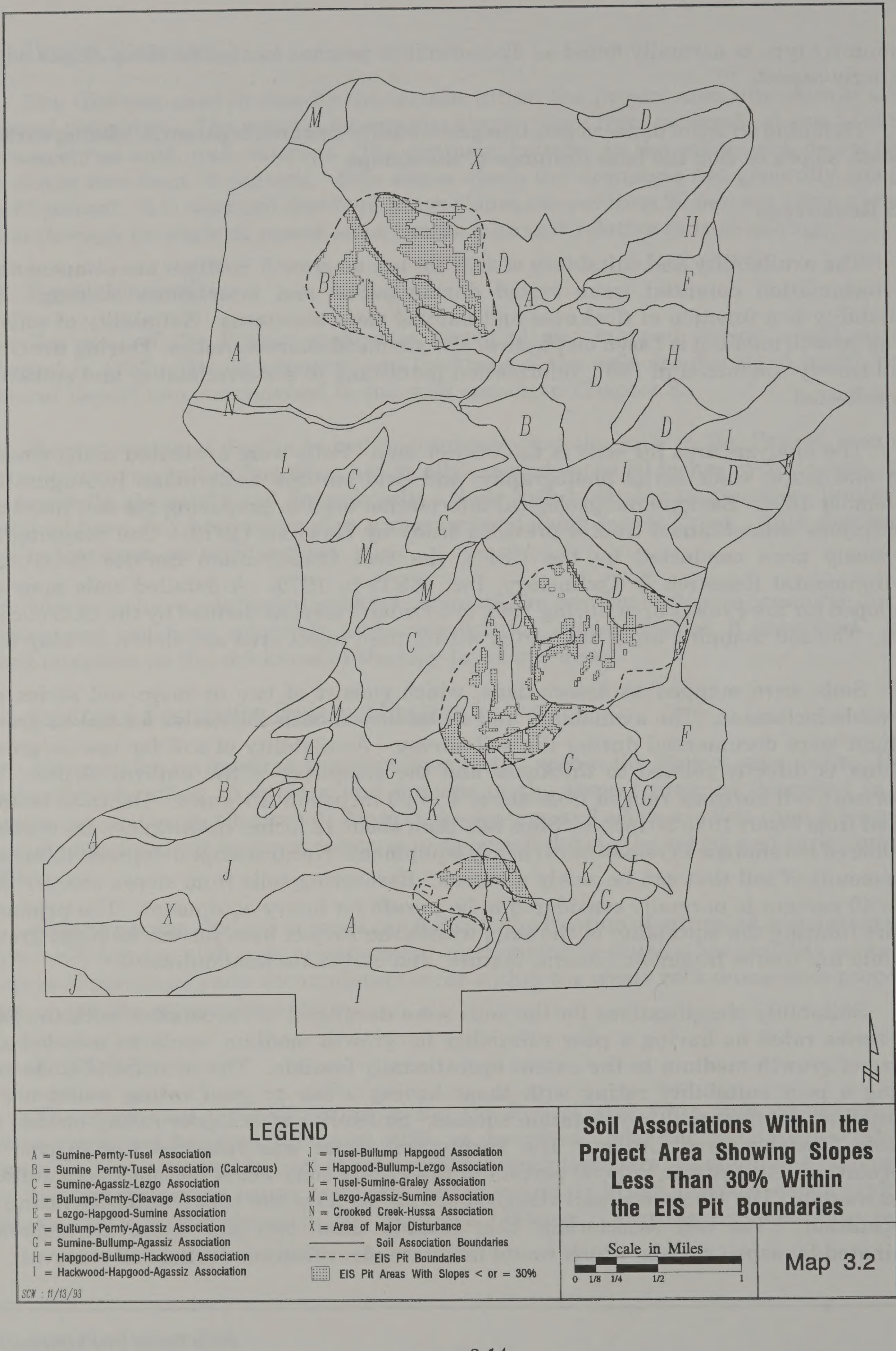
Soil Resources

The availability and suitability of soils for use as growth medium are components of the reclamation potential issue raised during public and interagency scoping. Soil availability is a function of thickness and natural slope steepness. Suitability of soils for use as growth medium is based on physical and chemical characteristics. During the Order 3 soil survey conducted in 1992, information pertaining to soil availability and suitability was collected.

The analysis area for soils is the Project area. Soils were evaluated using existing data and maps, color aerial photography, and field surveys undertaken in August and September 1992. Background geological information used in preparing the soil maps and descriptions was obtained from a previous study by Hawkins (1973). Soil mapping has previously been conducted by the USFS, the Soil Conservation Service (SCS), and Environmental Research & Technology, Inc. (ERT) in 1979. A detailed soils map was developed for the Project area during 1992 to a Order 3 level as defined by the SCS (USDA, SCS). The soil mapping units delineated within the Project area are shown on Map 3.2.

Soils were mapped as associations, which consist of two or more soil series and allowable inclusions. The availability and suitability of each soil series for use as growth medium were documented during the soil survey. Availability of soil for use as growth medium is directly related to thickness and the steepness of the natural slopes. The uppermost soil horizons ranged from about 4 to 60 inches in thickness. Depth to bedrock ranged from about 10 to 80 inches. Soils less than about 12 inches in thickness are typically considered too shallow to remove with heavy equipment. Natural slope steepness influences the amount of soil that can be safely accessed. Recovering soils from slopes steeper than 30 to 40 percent is normally considered to be unsafe for heavy equipment. The primary factors limiting the suitability of the soils within the Project area for use as plant growth medium are coarse fragment content, texture, and carbonate accumulations.

Suitability classifications for the soils were developed in cooperation with the SCS. Soil series rated as having a poor suitability for growth medium would be avoided as a source of growth medium to the extent operationally feasible. The mixture of some soils having a poor suitability rating with those having a fair or good rating would not be expected to interfere with revegetation success. Soil series with a poor rating include the Agassiz, Cleavage, and Graley. The Pernty soil series was rated as fair to poor for revegetation. As a result, only 50 percent of the Pernty soils would be considered suitable for salvaging. The Hackwood and Hapgood soil series have the best suitability rating for revegetation. The soil associations that include these two soil series are generally dominated by aspen stands, which would facilitate identification during soil removal.


M
D
X
H
D
B
F
A
A
H
D
N
B
D
I
L
C
I
D
C
D
M
M
D
D
C
I
M
A
G
G
F
B
X
I
K
X G
A
J
I
K
I
J
X
G
X
A
J
I
LEGEND
A = Sumine-Pernty-Tusel Association
B = Sumine Pernty-Tusel Association (Calcarcous)
C = Sumine-Agassiz-Lezgo Association
D = Bullump-Pernty-Cleavage Association
E = Lezgo-Hapgood-Sumine Association
F = Bullump-Pernty-Agassiz Association
G = Sumine-Bullump-Agassiz Association
H = Hapgood-Bullump-Hackwood Association
I = Hackwood-Hapgood-Agassiz Association
J = Tusel-Bullump Hapgood Association
K = Hapgood-Bullump-Lezgo Association
L = Tusel-Sumine-Graley Association
M = Lezgo-Agassiz-Sumine Association
N = Crooked Creek-Hussa Association
X = Area of Major Disturbance
Soil Association Boundaries
EIS Pit Boundaries
EIS Pit Areas With Slopes < or = 30%
SCW : 11/13/93
Soil Associations Within the Project Area Showing Slopes Less Than 30% Within the EIS Pit Boundaries
Scale in Miles
0 1/8 1/4 1/2 1
Map 3.2

Soil salvaging operations would focus on recovering suitable material in sufficient quantities within those portions of the pits that have slopes of 30 percent or less. The soils available for salvaging within the pits on slopes equal to or less than 30 percent are shown on Map 3.2. Additional growth medium would be recovered during mining as benches are developed on steeper slopes.

Parent material for soils within the Project area consists primarily of early Paleozoic sedimentary rock and minor material derived from igneous intrusions in the form of dikes and sills. Dominant rock types are argillite, chert, quartzite, and limestone. Argic (clay-rich) soils have formed where underlain by argillite and limestone, while loamy, pebbly soils have formed over bedded chert and quartzite rocks. Areas underlain by massive chert exhibit little soil development. Carbonate accumulation is present in soils on southfacing slopes and ridgetops underlain by limestone bedrock or colluvium.

Most of the soils in the Project area belong to three great groups: *Cryoborolls, Argixerolls and Haploxerolls*. Soils which have formed on slopes with a south aspect and on ridgetops are predominantly *Argixerolls* and *Haploxerolls*. Soils found on north and east facing slopes, some ridges and in high basin bottoms are predominantly *Cryoborolls*. Within the Project area, significant occurrences of valley bottom soil development are restricted to Jerritt Canyon and along Burns Creek. Characteristics of soil groups within the Project area are described below.

Cryoborolls occur on the northern and eastern slopes, on some ridges, and on high basin floors in the Project area. Soils within the Project area classified as *Cryoborolls* include the Hackwood, Hapgood, Lezgo and Tusel Series. These soil series are deep to very deep and tend to be well-drained. Slopes vary from 4 to 75 percent. Developed (A and B soil horizons) horizons range from 16 to 60 inches. Depth to bedrock ranges from 40 to over 80 inches. Textures include silt loams, gravelly silt loams, very gravelly sandy or clay loams, extremely gravelly loams and sandy clay loams. Suitability for salvage is fair to excellent depending on soil depth, slope and texture. Revegetation potential is fair and permeability ranges from rapid to moderately slow depending on percent clay content. These soils support the following types of vegetation: big sagebrush, snowberry, rabbitbrush, slender brome, Idaho fescue, quaking aspen, tall oniongrass, chokecherry, and arrowleaf balsamroot.

Argixerolls are found on south and west facing slopes and on some ridges where carbonate bedrock provides the parent material. Soils within the Project area classified as *Argixerolls* include the Bullump, Cleavage, Graley, Pernty and Sumine Series. Soils in these series are generally shallow, ranging to deep, and are well-drained. Slopes vary widely from 2 to 75 percent and permeability is moderately slow to slow due to relatively high clay content. Developed horizons are relatively thin, ranging from 7 to 15 inches, with the exception of the Bullump soil series which has thick developed horizons ranging from 20 to 40 inches. Depth to bedrock varies from 14 to 40 inches, except in the Bullump Series, where the range is 40 to 80 inches. Textures include very cobbly and extremely gravelly loams, very gravelly clay loams and clays. Suitability for salvage is poor to marginal due

to clay and gravel content, except for the Bullump Series soils which are highly suitable. Revegetation potential is generally poor to fair. Vegetation supported by these soils includes: big sagebrush, snowberry, serviceberry, bluebunch wheatgrass, brome, Thurber needlegrass, low sagebrush, rabbitbrush, Idaho fescue, Great Basin wildrye, cheatgrass, and antelope bitterbrush where soil is carbonatic.

Haploxerolls occur primarily on ridges and upper side slopes where parent material is siliceous bedrock. Soil series within the Project classified as *Haploxerolls* include the Agassiz Series. These are well-drained shallow soils with thin developed horizon of 4 to 12 inches. Depth to bedrock ranges from 10 to 20 inches and slopes vary widely from 2 to 75 percent. Textures include very cobbly loams, gravelly loams and extremely gravelly loams. Suitability for salvage is marginal due to thin organic surface layers and high gravel content. Permeability is moderate and revegetation potential is poor. These soils support the following vegetation: low sagebrush, bluegrass, Idaho fescue, and bottlebrush squirreltail.

Within the Project area there are minor occurrences of rock outcrop and talus, of Cryorthent and Cryumbrept soils on the upper mountain slopes and ridges, and Fluventic Haplaquolls along the stream channels. These and other minor inclusions were not quantified nor described in the soil associations.

Calculations of K factor (soil erodibility) values for soils within the Project area indicates they have generally low to moderate susceptibility to erosion where disturbed. Undisturbed soils have very low to moderate susceptibility to erosion.

Climatology and Air Quality

Abatement of fugitive dust (particulate emissions) was identified through public and agency scoping as an issue related to air quality. Air quality is affected by climatology, or weather patterns. Wind and precipitation, for example, can affect the air quality in a specific location by causing particles to be transported downwind or washed out.

The analysis area for climatology focuses on the Project area and, for purposes of examining air quality standards, includes an area within 60 miles (100 kilometers) of the Project area. The nearest Class I area, Jarbidge Wilderness, is located approximately 30 miles (50 kilometers) northeast of the Project area. Because existing air quality and climatology data for the Project area are limited, data sources include areas to the east and south of the Project area.

Climatology

The climate in the Project area follows general trends for the state of Nevada, but is also strongly affected by local topographic features, specifically, the Independence Mountains.

Wind Patterns

The surface wind pattern is highly dependent on local variations in topography. The Independence and North Fork Valleys generally channel strong prevailing winds in a north-south direction.

Several components of the mountain-valley wind systems dominate the local air flows in the Jerritt Canyon area. The north-south oriented Independence Mountains cause a weak diurnal surface wind pattern. Shallow upslope winds result from heating of the valleys on both sides of this range during the daytime. The western slopes of the range experience a westerly upslope flow originating from the Independence Valley. Easterly slope winds flow up the east side of the range from the North Fork Valley. During strong prevailing westerly wind conditions, the easterly upslope winds may disappear. At night, the direction of the flow pattern is reversed. Weak, shallow, gravity-driven drainage winds flow down both sides of the Independence Mountains. Any large canyons in the range, such as Jerritt Canyon, channel and enhance the drainage of mountain winds.

The general wind pattern is predominantly westerly and southwesterly. Hourly average wind speeds range from a minimum of one mile per hour to 34 miles per hour at the mill site located to the east of the Project area.

Precipitation and Temperature

Average precipitation within the Project area varies from about 12 inches at the 6,000 foot level to more than 26 inches above the 8,000 foot level (ERT 1979d), the majority of which falls as snow during the winter. The climate is typical of the Northern Great Basin with rather severe winters and mild to hot summers. Some snow persists in the higher elevations until July, and additional precipitation in the summer falls during thunderstorms. Average annual precipitation for Project area watersheds is included in Table 3.3.

Most of the precipitation supplied to the Project area is lost through evapotranspiration. Estimates by the USGS suggest that over 80 percent of precipitation in this vicinity is lost through evapotranspiration near its point of deposition. It is either lost immediately upon falling or later in the year following seasonal storage as snow or soil moisture. Of the approximately 20 percent of total precipitation that becomes runoff or groundwater, nearly all is ultimately lost through evapotranspiration within the river valleys (ERT 1979d).

The Project area elevation affects temperature. At the highest elevations, the temperature range is less than at lower elevations. Winter temperatures may be warmer and summer temperatures cooler than at lower elevations. Data collected on the eastern side of the Independence Mountains and adjacent to the general study area indicate minimum temperatures from 0° to -8° Fahrenheit and maximum temperatures in the 90's at the 6,600 and 7,600 foot elevations.

Table 3.3
Average Annual Precipitation for Project Area Watersheds

Watershed	Area (Square Miles)	Precipitation (in/yr)
Jerritt Creek		
Upper Subbasin	3.09	26
Lower Subbasin	5.95	18
N. Fork Jerritt Creek		
Upper Subbasin	2.10	26
Lower Subbasin	1.34	18
S. Fork Jerritt Creek	4.49	18
Mill Creek	1.63	18
Burns Creek	6.67	18
Snow Canyon Creek[1]	9.16	26

Source: Environmental Research & Technology 1979. Surface Water Technical Report, pages 18-19.
Note: [1] Only a small portion of this watershed with no water course falls within the Project area.

Air Quality

The background quality of air in the Jerritt Canyon area is excellent. The air quality parameter of primary interest due to proposed mining activities is particulate matter less than 10 microns in size (PM_{10}) from emissions of fugitive dust. The National Ambient Air Quality Standard (NAAQS) for PM_{10} is 50 micrograms per cubic meter (g/m^3) annual arithmetic average and 150 g/m^3 maximum 24 hour average. Other regulated pollutants which may be emitted into the air as a result of mining activities include sulfur dioxide (SO_2), carbon monoxide (CO), and nitrogen dioxide (NO_2).

The only air quality data in or adjacent to the Project area are from monitoring sites near the Jerritt Canyon mill. PM_{10} concentrations were measured at two sites near the mill from April 1990 to May 1991. One site was downwind from the mill facilities and the other was set up as a background site upwind from the mill. The arithmetic average of the PM_{10} values measured during this time was 10 g/m^3 at both monitoring sites, thus indicating that the mill did not contribute particulate matter in the PM_{10} size range at concentrations higher than background PM_{10} levels (Desert Research Institute 1991a-e).

$S0_2$ concentrations are not routinely measured in Elko County. Given the absence of SO_2 sources, other than mine-related activities in the Jerritt Canyon Project area, it can be assumed that background SO_2 levels are minimal. The 1980 FEIS indicated that, based on

air quality modeling, the SO_2 effects from mine emissions are expected to be minimal. The maximum predicted concentrations were 12 percent of state and federal standards. The maximum predicted concentrations were also predicted to occur close to the mill rather than from excavating or other mining operations that would take place in the proposed Project area.

The area surrounding Jerritt Canyon is designated attainment for all criteria pollutants (SO_2, CO, NO_2, PM_{10}, ozone, and lead), meaning that the area complies with all NAAQS for these pollutants. The region surrounding the Jerritt Canyon facilities is designated Group III for PM_{10}, meaning that the EPA, in conjunction with NDEP, has determined that there is less than 20 percent probability that there would be exceedances of the federal PM_{10} ambient air quality standard (USDI, BLM 1989).

The Prevention of Significant Deterioration (PSD) Class I area nearest to Jerritt Canyon is the Jarbidge Wilderness, approximately 30 miles (50 kilometers) northeast of Jerritt Canyon. There are no integral vistas associated with the Jarbidge Wilderness (USDI, BLM 1989).

NDEP has issued air quality permits for surface area disturbance and for a portable crushing and screening system for IMC's existing operations at Jerritt Canyon. The permit for surface area disturbance includes 1,951 acres of pit area, 3,823 acres of waste or overburden piles, 25 acres of ore storage areas, 735 acres of haul roads, 1,500 acres of plant site, 12 acres of leach pads, and 25 acres for miscellaneous uses, for a total of up to 8,071 acres. This permit requires that fugitive dust emissions from all disturbed areas be controlled by use of the best practical methods such as watering, chemical stabilization, or other controls.

In March 1993, NDEP issued air quality permits for construction of a mine crushing and screening system. This system includes: 1) a primary jaw crusher, apron feeder, and associated conveyors; 2) two primary screens, splitter box, conveyors, and radial stacker; 3) two secondary cone crushers and associated conveyors; and 4) diesel generators. The permit specifies monitoring measures to ensure that particulate emissions are properly controlled.

As part of its application for air quality permits, IMC used dispersion models to predict impacts on air quality from the proposed portable mine crushing and screening system at the Jerritt Canyon mine. The predicted concentrations of PM_{10} from these sources range from 7.04 to 72.08 $\mu g/m^3$ for the 24-hour averaging period, and from 1.60 to 20.27 $\mu g/m^3$ for the annual averaging period. The national ambient air quality standards (NAAQS) for PM_{10} are 150 $\mu g/m^3$ for the 24-hour averaging period and 50 $\mu g/m^3$ for the annual averaging period.

Surface Water Resources

The general study area is located within the southernmost reaches of the Snake River Basin. The main waterbodies in the Snake River Basin are Big Goose Creek, Salmon Falls

Creek, Shoshone Creek, East Fork of the Jarbidge River, Jarbidge River, West Fork of the Bruneau River, South Fork of the Owyhee River, the Owyhee River, Wilson Reservoir and Wild Horse Reservoir (NDEP 1992).

The primary hydrologic features of the region surrounding the general study area are the South Fork of the Owyhee River to the west and the North Fork of the Humboldt River to the east. The most significant hydrologic feature in the general study area itself is the drainage divide formed by the ridgeline of the Independence Mountains. Streams draining the eastern side of this divide are tributary to the North Fork of the Humboldt River which drains to the Humboldt Sink in the Great Basin. There are no tributaries in the Project area that drain to the North Fork of the Humboldt River. Drainages on the west side of the divide flow into the South Fork of the Owyhee River, which eventually discharges to the Snake River. Western slope tributaries within the Project area include Jerritt Creek and Burns Creek, which both drain to the South Fork of the Owyhee River, and Mill Creek, a tributary to Burns Creek. Map 3.3 displays watershed boundaries of these drainages and the locations of surface monitoring stations.

Historical data indicate that peak runoff from the Independence Mountains occurs in May and June due to melting of winter snowpacks. An average of 68 percent of the annual flow occurs between March and June (ERT 1979d). The hydrograph in Figure 3.1 presents flow data collected from 1959 to 1984 on the South Fork of the Owyhee River at the USGS stream gage (Gage No. 13177200) at Spanish Ranch near Tuscarora, Nevada.

The CEA province for surface water analysis consists of third order watersheds within the Project area and includes: Jerritt Creek; Burns Creek; Mill Creek; Snow Canyon; and a very small portion of an unnamed watershed located between Mill Creek and Burns Creek. Only a small area of the Snow Canyon watershed falls within the bounds of the Project area. The total area of third order watersheds and the percentage of existing disturbance within each are displayed in Table 3.4. The Mill Creek and Snow Canyon watersheds would not be affected by any of the action alternatives, therefore, these watersheds are not addressed in the remainder of this document.

Surface Water Quantity

USGS classifies Jerritt and Burns Creeks as intermittent or perennial streams within the Project area. Stream flow data collected over the past 15 years and field observations suggest that the majority of these streams are actually intermittent or ephemeral within the Project area.

<u>Jerritt Creek</u>

Jerritt Creek is classified by the USGS as both an intermittent or perennial stream within the Project area. The Jerritt Creek watershed is approximately 12.7 square miles (8,106 acres) in size. Stream flow data are limited and include measurements obtained during 1978, 1979, 1989, 1991, and 1992 which suggest the majority of this stream is intermittent. Average stream discharge was less than 0.01 cubic feet per second (cfs) in

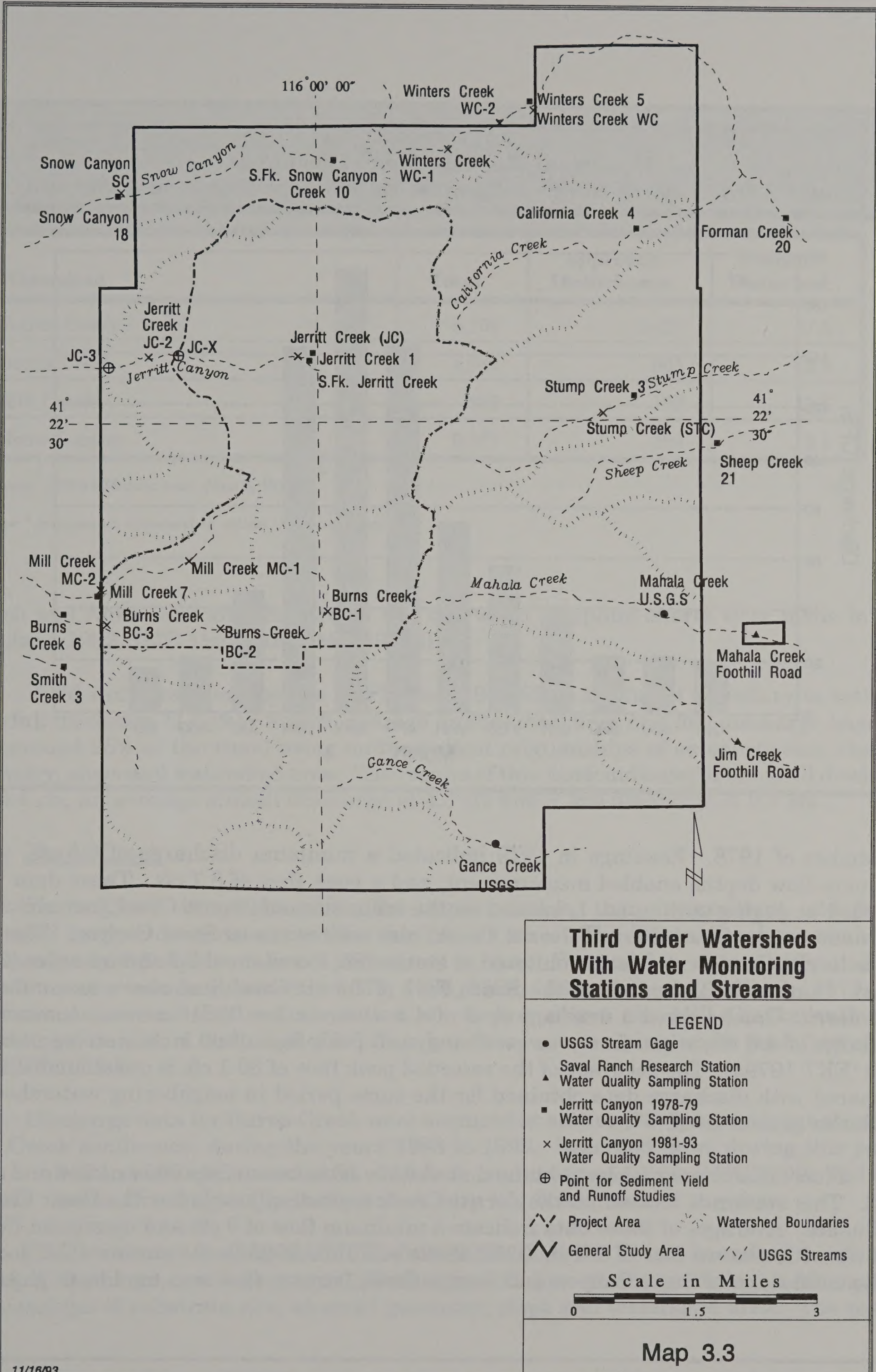
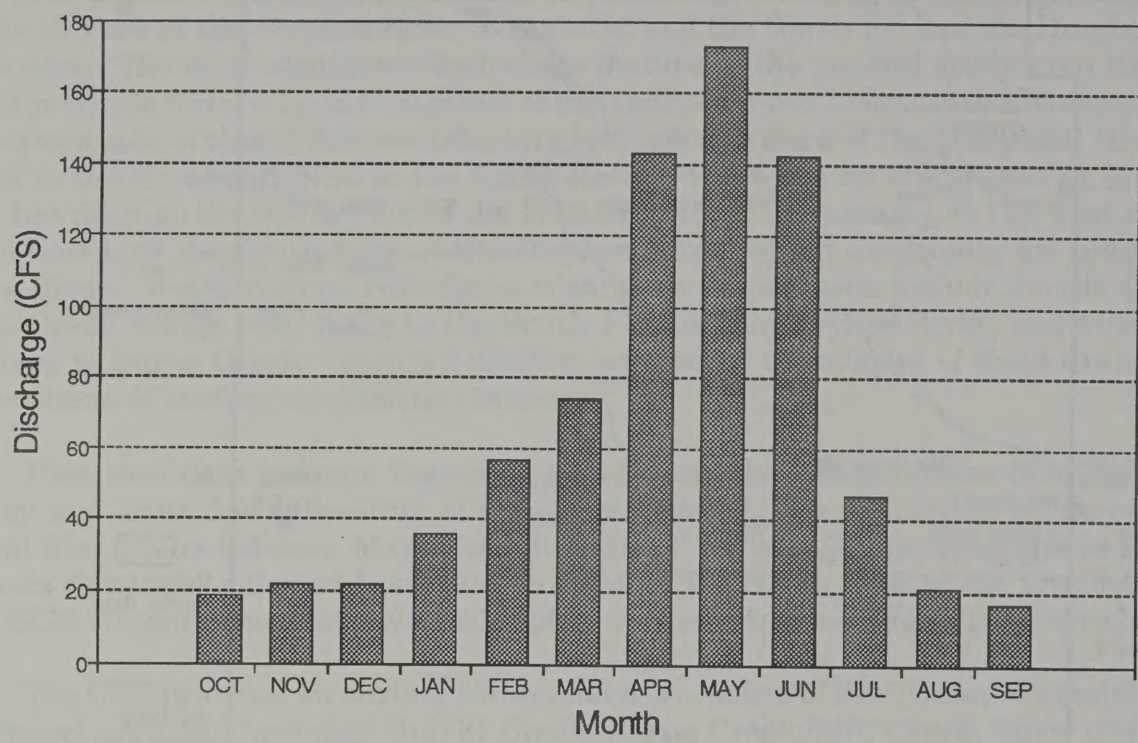

116°00' 00"
Winters Creek
WC-2
Winters Creek 5
Winters Creek WC
Snow Canyon
SC
Snow Canyon
S.Fk. Snow Canyon
Creek 10
Winters Creek
WC-1
Snow Canyon
18
California Creek 4
Forman Creek
20
California Creek
Jerritt
Creek
JC-2
JC-X
JC-3
Jerritt Canyon
Jerritt Creek (JC)
Jerritt Creek 1
S.Fk. Jerritt Creek
Stump Creek 3
Stump Creek
41°
22'
30"
Stump Creek (STC)
Sheep Creek
Sheep Creek
21
Mill Creek
MC-2
Mill Creek MC-1
Mill Creek 7
Burns Creek
BC-1
Burns Creek
BC-3
Burns Creek
BC-2
Burns Creek 6
Smith Creek 3
Mahala Creek
Mahala Creek
U.S.G.S
Mahala Creek
Foothill Road
Jim Creek
Foothill Road
Gance Creek
Gance Creek
USGS
Third Order Watersheds
With Water Monitoring
Stations and Streams
LEGEND
USGS Stream Gage
Saval Ranch Research Station
Water Quality Sampling Station
Jerritt Canyon 1978-79
Water Quality Sampling Station
Jerritt Canyon 1981-93
Water Quality Sampling Station
Point for Sediment Yield
and Runoff Studies
Project Area
Watershed Boundaries
General Study Area
USGS Streams
Scale in Miles
0
1.5
3
Map 3.3
11/16/93

Figure 3.1
Historical Monthly Mean Discharge
South Fork Owyhee River at Spanish Ranch near Tuscarora, Nevada



September of 1978. Readings in 1979 indicated a minimum discharge of 0.5 cfs, when adequate flow depths enabled measurement, and a peak flow of 8.7 cfs. These data were recorded at gaging station no. 1, located on the main stem of Jerritt Creek just above the confluence of the South Fork of Jerritt Creek, also referred to as Steer Canyon. The area of the Jerritt Creek watershed monitored at station no. 1 contained 3.3 square miles (2,112 acres). Station no. 2, located on the South Fork of Jerritt Creek just above its confluence with Jerritt Creek, gaged a drainage area of 4.4 square miles (2,816 acres). A minimum discharge of 4.8 cfs, when flow was occurring, and peak flow of 80.1 cfs were recorded in 1979 (ERT 1979d). The accuracy of the recorded peak flow of 80.1 cfs is questionable when compared with discharge data obtained for the same period in neighboring watersheds of similar or greater area.

Flow measurements were obtained at station JC between September 1984 and June 1993. This station is located on the Jerritt Creek mainstem just below the Steer Canyon confluence. Averages of these data indicate a minimum flow of 0 cfs and maximum flow of 16.8 cfs with a mean flow of 1.6 cfs (IMC 1992e and IMC 1993d). At station JC-2, located at the confluence of Steer Canyon and Jerritt Creek, stream flow was too low to gage in

Table 3.4
Approved Disturbance by Watershed (in Acres)[1]

Watershed	Total	Approved Disturbance	Percent Disturbed
Jerritt Creek	8,106	1,420	17.5
Burns Creek	4,040	504	12.5
Mill Creek	982	192	19.6
Snow Canyon	6,337	198	3.1

Source: USFS GIS data base, June 3, 1993.

Note: [1] Includes all of watershed within USFS boundary.

March and April 1992 and the stream was dry when sampling efforts were made in May and June 1992 (IMC 1992e and IMC 1993d).

Field work was done by the USFS from 1989-92 at the forest boundary to estimate bankfull discharge (1.5 year event), average annual discharge and low discharge (equal to or exceeded 95% of the time) using mathematical relationships of substrate size, channel geometry, slope and watershed area. The results of this work indicated a bankfull discharge of 28.4 cfs, an average annual discharge of 4.3 cfs and a low discharge of 0.4 cfs.

<u>Burns Creek</u>

Burns Creek is ephemeral in the upper reaches, then intermittent and finally perennial farther downstream within the Project area. The Burns Creek watershed is approximately 6.3 square miles (4,038 acres) in size. Stream flow data are limited and include measurements obtained in 1979, 1988, 1989, 1990, 1991 and 1992. In 1979, flow measurements were obtained at station no. 6, just above the Mill Creek confluence, indicating a minimum discharge of 2.5 cfs, when flow was occurring, and a peak flow of 40.0 cfs (ERT 1979d).

Discharge data for Burns Creek were acquired at station BC-3, located just above the Mill Creek confluence, during the years 1988 to 1993. Recorded flows during this period were a minimum of 0 cfs, a maximum of 14.6 cfs, and mean of 4.5 cfs (IMC 1992e and IMC 1993d). Burns Creek typically is dry or has very low flows much of the year.

Field work was done by the USFS from 1989-92 at the Forest boundary to estimate bankfull discharge, average annual discharge and low discharge using mathematical relationships of substrate size, channel geometry, slope and watershed area. The results

of this work indicated a bankfull discharge of 12.1 cfs, an average annual discharge of 2.8 cfs and a low discharge of 0.3 cfs.

Surface Water Quality

General Water Quality - South Fork Owyhee/Snake River Basin

The South Fork of the Owyhee River was classified as "water quality limited" (NDEP's 1979 Water Management (208) Plan) because temperatures of 33.3 percent of the samples taken exceeded the standard of 21° C (May-October) or 13° C (November-April). The maximum reading was 13 percent over the standard (NDEP 1992).

The 1991 Water Management (208) Plan for the Non-Designated Area of Nevada indicates that with the exception of eutrophic conditions in Wilson and Wild Horse reservoirs, low flows and summertime temperature problems at various points in the streams, there were no other chronic water quality problems identified within the Snake River Basin (NDEP 1992).

Surface Water Sampling Program - Project Area

Water quality data were collected on streams in the general study area every month from September 1978 to August 1979 as part of the baseline studies for the original Jerritt Canyon Project EIS (ERT 1979g). Samples were collected from the surface water stations shown on Map 3.3. Field measurements included temperature, pH, dissolved oxygen and total alkalinity. The following parameters were also included in sample analysis: chemical oxygen demand (C.O.D.); color; turbidity; total dissolved solids; ammonia; nitrate; total phosphate; cyanide; calcium; magnesium; potassium; sodium; sulfate; chloride; metals; and coliform bacteria.

Monthly water quality data collection resumed in 1981 on Jerritt Creek and additional water quality monitoring stations were established between 1986 and 1988, at the locations shown on Map 3.3 (IMC 1992e). Station JC was established on Jerritt Creek just below the Steer Canyon confluence and station JC-2 was established downstream on the mainstem. The JC station has been sampled since July of 1981. The JC-2 station was sampled twice in 1992. Sampling has been conducted at one station on Burns Creek (BC-3) since 1987, and from two stations on Burns Creek (BC-1 & BC-2) since 1988.

Sampling parameters in the more recent program have changed slightly from the 1978-1979 study. Field parameters now include flow, temperature, pH and specific conductance. Ammonia, cyanide, and coliform bacteria are no longer measured. In 1992, total suspended solids (TSS), arsenic, and metals were added to the analysis list.

Summaries of surface water quality monitoring data from the 1978-1979 study and from the 1981-1992 sampling program are presented in Table 1 and Table 2, respectively, in Appendix F. Surface water quality standards are included in Appendix F. Data from both investigations indicate that the study area streams contain moderately hard, calcium

carbonate type water. Water tends to flow mainly in response to spring runoff, and concentrations of dissolved constituents tend to vary depending on the relative components of precipitation, surface water runoff, and groundwater that enter the stream.

A comparison of data gathered in the 1981-1992 program with data from the 1978-1979 study reveals that, in general, pH values have remained between 6.2 and 8.6. Average pH values during 1981-1992 ranged from 8.0 to 8.5. Average TSS ranged from 8.0 mg/l (downstream) to 22.0 mg/l (upstream) at two monitoring sites in Jerritt Creek. The monitoring station above the existing Burns Basin pit averaged 278.0 mg/l but TSS levels dropped to 16.0 mg/l and 9.0 mg/l at downstream monitoring sites below the mining disturbance areas. Total dissolved solids (TDS) appear to have increased in Burns Creek since the 1978-1979 study, but have consistently remained below the "beneficial use" standard except on one occasion after a major storm event.

Chloride measurements for Jerritt Creek taken from 1981 to 1992 were generally higher than in the earlier study but did not exceed the "beneficial use" standard for chloride in the South Fork of the Owyhee River system or the EPA National Interim Drinking Water Regulations standard for public drinking water supplies. Jerritt Creek, tributary to the South Fork of the Owyhee, is not a public drinking water supply.

Total phosphorus values appear to be lower in the recent studies where comparisons can be made to 1978-1979 data. Nitrate values have decreased in Jerritt and Burns Creeks since the 1978-1979 study. Total iron also appears to have decreased. Arsenic was added to the sampling list in the recent studies but did not exceed the current National Primary Drinking Water Standard Maximum Contaminant Level (MCL) of 0.1 mg/l at any sampling station for any sampling event. Other metals which had exceeded MCLs in the original study were chromium and lead, but these were not sampled in the recent program.

The only stream within the Project area which supports a fishery is Burns Creek. According to the pre-mining data, average chromium concentrations exceeded the chronic criterion and average copper and zinc concentrations exceeded both the chronic and acute EPA freshwater aquatic life criteria. The one lead sample above detection limits (0.07 mg/l) exceeded both the acute and chronic criteria. Mercury data obtained from Burns Creek station BC-3 in 1987 and 1988 never exceeded the detection limit of 0.0005 mg/l.

Groundwater Resources

The primary issue associated with groundwater is the potential for acid rock drainage to affect the quality of groundwater. Other issues are the potential for groundwater to be impounded in the pits and effects to the flow of Niagara and Van Norman Springs.

Groundwater occurs throughout the Project area at depths ranging from the ground surface in areas of springs to several hundreds of feet in upland areas. The consolidated sedimentary and igneous rocks of the Independence Mountains generally exhibit low permeability, but transmit water locally through fractures and limestone solution cavities.

Local groundwater barriers formed by faults or by low permeability rocks have created a complex pattern of perched and semi-perched groundwater (Eakin and Lamke 1966).

Groundwater Quantity

Data on groundwater elevations from exploration drill holes and four groundwater monitoring wells indicate that groundwater within the Project area occurs in perched zones and in a deeper regional groundwater water table. The regional groundwater system in the vicinity of the Project area is assumed to encompass the western slopes of the Independence Mountain Range from the drainage divide between Jerritt Canyon and Snow Canyon on the north to Burns Creek on the south and extending into the Independence Valley on the west. The elevation of the regional groundwater surface varies with topography. Hydrogeologic cross sections indicate that both perched groundwater and unperched groundwater flow is controlled by faults, solution cavities or karst features in limestones, and the permeability of the various rock units. Groundwater is locally perched in argillized (clay altered) layers or in gouge zones associated with low angle faults. Groundwater levels measured in three monitoring wells in the New Deep mine area exhibited minor seasonal fluctuations of less than 35 feet, consistent with what would be expected of a regional groundwater surface. Groundwater flow is typically unconfined, although locally confined conditions were observed during drilling. None of the existing pits encountered the regional groundwater surface but several have intersected perched zones. The elevation of the regional groundwater surface is estimated to be at approximately 6,100 feet in the New Deep mine area, 6,382 feet in the Saval and Steer mine area, and 6,500 feet in the Burns Basin mine area. Water that enters the existing pits evaporates or infiltrates the fractured rock in the pit bottoms, and none is impounded.

The majority of groundwater recharge within the Project area and the adjacent valleys occurs as precipitation, mainly snow, falling in the mountains. Groundwater discharge occurs as flow from springs, evapotranspiration, and seepage to the creeks and their tributaries (Eakin 1962). Average annual recharge and discharge have not been estimated for the Independence Mountains or for Independence Valley.

Water production varies throughout the Project area but is generally low. Water was reported in 462 holes out of the approximately 1,800 holes drilled in the Saval, Steer and New Deep mine areas. Water production was measured in drill holes in which water flow was greater than five gallons per minute (gpm). Flows of 5 to more than 25 gpm were reported from some exploration holes in fracture zones, and some holes encountered flows as high as 100 gpm. Water production is controlled by fractured zones associated with faults, solution cavities associated with silicification, and a relict karst system in limestone in the Burns Basin area. The temperature of groundwater in the New Deep area ranges from 36 to 95°F, indicating localized geothermal conditions.

A karst system of interconnected solution cavities is present in some areas in the carbonate rocks of the Burns Basin mine area (USFS 1985a). A fluorescein dye tracer study performed in 1985 indicated that the spring located in Burns Creek about one-half mile

inside the western Forest boundary drains the karst system underlying the Burns Basin mine area. The tracer was not observed in any other springs.

Springs and Seeps

A spring and seep survey conducted in the Project area in the summer of 1993 identified 23 springs and 8 seeps in the Project area (Map 3.4). Spring flow data obtained during the 1993 survey is summarized in Table 3.5. With the exception of Niagara and Van Norman Springs, all of the springs that were measured had flows less than 20 gpm and most were less than 5 gpm. Flow in Niagara Spring has been measured monthly for the past ten years and averages 3,361 gpm, although the rate recorded is highly variable, ranging from 1,523 to 9,337 gpm. Van Norman Spring flows have also been measured for the past ten years and average 1,233 gpm, with a range of 444 to 6,700 gpm. These springs emanate from high angle north-south trending range front faults that form the western boundary of the Independence Mountains.

Groundwater Quality

Water quality analyses of samples from groundwater monitoring wells in the New Deep mine area (shown on Map 3.4) are summarized in Table 3.6. The groundwater in this area is calcium magnesium bicarbonate type water with an average TDS of 310 mg/l and average pH of 7.1. The quality of this water generally meets or exceeds primary state and federal standards established for drinking water, irrigation, and livestock, with the exception of iron and manganese. No groundwater quality data is available for the Saval, Steer or Burns Basin areas other than sampling results from springs and seeps. During development drilling in the summer of 1993, attempts to acquire additional water quality samples were unsuccessful due to the limited water encountered in all of the mine areas.

Water samples were collected from the springs and seeps within and adjacent to the New Deep, Saval, Steer, and Burns Basin mine areas. Water quality analysis results are summarized in Table 3.7. The similarity of groundwater chemistry from springs and seeps, particularly those that emanate from the regional groundwater system, and from monitoring wells suggests that spring and seep water quality is a general indicator of groundwater quality throughout the Project area.

Springs GDSP-10 and MCDS-10 in the New Deep mine area have calcium magnesium sulfate type water, an average pH of 7.85, and high total dissolved solids (TDS) and sulfates that exceed secondary drinking water standards. The high TDS and sulfate concentrations for these two springs may indicate groundwater in equilibrium with ore deposits or the influence of adjacent and upgradient waste rock dumps. The sulfate in the groundwater may be the result of oxidation of pyrite and/or dissolution of sulfate minerals. As shown in Table 3.7, these spring samples exceed some of the secondary standards for drinking water and agriculture use.

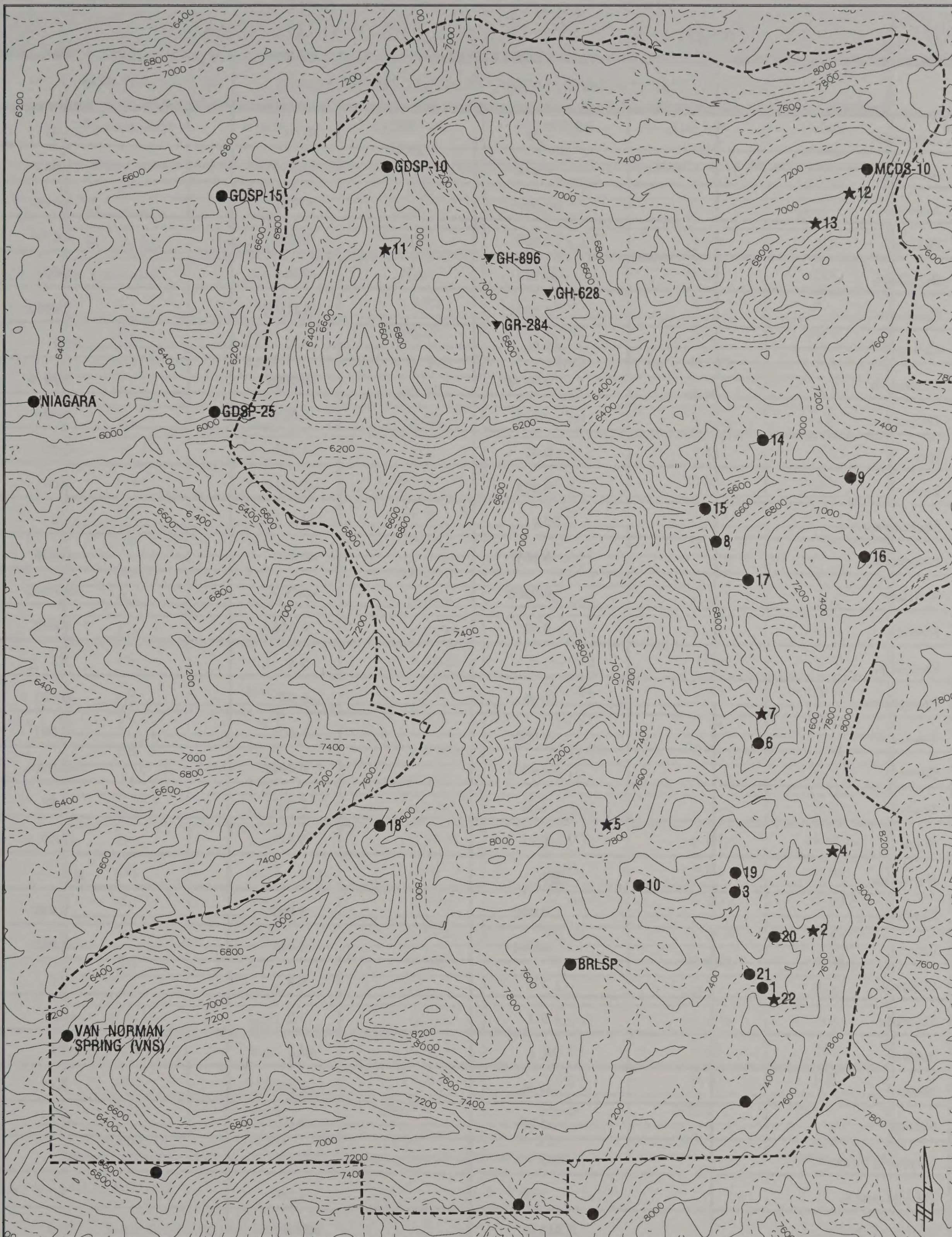
The remainder of the springs in the Project area have calcium magnesium bicarbonate and calcium bicarbonate type waters. These types of water are typical of

Table 3.5
Spring and Seep Classification and Flow Rates

Spring/Seep ID Number	Estimated GPM	Classification	Elevation (feet)
1	<1	spring	7,300
2	-	seep	7,500
3	<0.5	spring	7,420
4	-	seep	7,740
5	-	seep	7,625
6	0.5	spring	7,290
7	-	seep	7,130
8	1	spring	6,620
9	0.5	spring	6,850
10	<0.5	spring	7,600
11	-	seep	6,725
12	-	seep	7,000
13	-	seep	6,900
14	0.5	spring	6,775
15	2	spring	6,450
16	1.75	spring	6,825
17	3	spring	6,800
18	10	spring	7,650
19	NA	spring	7,500
20	10	spring	7,400
21	<0.1	spring	7,280
22	-	seep	7,380
BRL-SP	20	spring	7,380
GDSP-10	NA	spring	6,850
GDSP-15	3	spring	6,725
MCDS-10	17	spring	7,170
GDSP-25	NA	spring	6,025
Niagara	3,361[1]	spring	6,050
Van Norman Spring	1,233[2]	spring	6,210
4 unnamed springs in far South section of project area	NA	spring	7,550 7,400 7,390 6,100

Source: IMC 1993

Note: NA = Not Available
[1] average value 2/82 to 5/92
[2] average value 1/83 to 5/92



LEGEND

- ● Spring Locations
- ★ Seep Locations
- ▼ New Deep Groundwater Monitoring Wells
- —·—·— Project Area Boundary

SCW : 3/18/94

Springs, Seeps, and Monitoring Wells

Scale in Miles

0 1/8 1/4 1/2 1

CONTOUR INTERVAL 100 FEET

Map 3.4

Table 3.6
Water Quality Analysis Results
Monitoring Wells GH-896, GR-284, GH-628A[1]

	GH-896	GR-284	GH-628A
Aluminum	0.03	<0.01	<0.01
Antimony	0.004	0.007[1]	0.003
Arsenic	<0.001	<0.021	0.014
Barium	0.085	0.030	0.074
Beryllium	<0.001	<0.001	<0.001
Cadmium	0.0001	<0.0001	0.0003
Calcium	55.2	67.3	59.1
Chromium	0.0012	0.0009	0.0010
Copper	0.012	0.075	0.009
Iron	0.07	4.19[2]	<0.02
Lead	0.004	<0.001	0.001
Magnesium	36.8	43.3	34.2
Manganese	0.157[2]	<0.075	0.026
Mercury	<0.0002	<0.0002	<0.0002
Nickel	0.007	0.004	0.005
Potassium	1.7	2.4	2.1
Phosphorus	<0.03	<0.03	<0.03
Selenium	<0.001	0.001	<0.001
Silver	<0.0001	0.0002	<0.0001
Sodium	7.82	7.23	9.28
Silica	5.71	8.67	14.00
Hardness	289	346	288
Thallium	0.002	0.002	0.002
Zinc	0.084	0.043	<0.002
Chloride	3.7	4.6	2.6
Fluoride	0.3	0.2	<0.1
Sulfate	31.1	82.5	43.6
Nitrate	<0.05	<0.05	0.17
Nitrite	<0.05	<0.05	<0.05
Conduct.(mhos)	550	655	558
pH (pH units)	7.00	7.20	7.10
Turbidity (NTU)	2,840.0	357.0	85.6
TDS	270.0	361.0	299.0
TSS	1,430.0	165.0	173.0

Source: IMC 1993

Note: All analyses in mg/l unless otherwise noted
< Indicates values less than the limit of detection
[1] Location of monitoring wells shown on Map 3.4
[2] Does not meet state and federal drinking water standards

Table 3.7
Water Quality of Springs and Seeps in the Jerritt Canyon Mine Expansion Analysis Area[1]

Parameter	Units	GDSP-10 (Avg)[2]	GDSP-25 (Avg)[2]	BRLSP (Avg)[2]	VNS (Avg)[2]
pH	pH units	7.74	7.355	7.275	7.76
Bicarb.Alk.	mg/l	371	237	130	222
Bicarb.Alk.	meq/l CaCO	6.1	4.88	2.08	NA
Carb.Alk.	mg/l	NA	NA	NA	NA
Cl	mg/l	8.25	4.5	5.1	4
SO_4	mg/l	1295.5[3]	53.95	3.4	36
NO_3	mg/l	1.905	<0.05	0.185	0.3
NO_2	mg/l	<0.05	<0.05	<0.05	NA
Na	mg/l	13.65	5.92	3.075	3.9
K	mg/l	2.1	1.6	1.1	1.05
Ca	mg/l	298.5	61.8	33.2	55.9
Mg	mg/l	190.5	33.4	9.36	24.4
Al	mg/l	0.48	0	0.35	NA
As	mg/l	<0.001	0.011	0.012	0.03
Ba	mg/l	0.069	0.047	0.359	NA
Cd	mg/l	0.0015	<0.002	<0.01	<0.01
Cr	mg/l	0.0025	<0.002	<0.05	<0.05
Cu	mg/l	0.0025	<0.004	<0.02	<0.02
Fe	mg/l	1.06[3]	0.067	0.157	<0.02
Pb	mg/l	0.0035	0.0035	<0.05	<0.05
Li	mg/l	<0.003	0.005	<0.003	NA
Mn	mg/l	0.709[3]	0.004	0.009	NA
Hg	mg/l	<0.0004	<0.0002	<0.0005	<0.0005
Ni	mg/l	<0.04	<0.04	<0.04	<0.04
Se	mg/l	0.001	<0.04	0.0005	0.001
Ag	mg/l	<0.002	<0.002	<0.002	NA
Zn	mg/l	0.055	0.0115	0.004	<0.02
F	mg/l	<0.1	0.1	<0.1	NA
B	mg/l	0.023	0.007	<0.006	NA
P	mg/l	0.05	<0.01	0.02	NA
Si	mg/l	14.8	6.7	9.45	9.5
TDS	mg/l	2097[3]	296.5	132.5	265
Cond.	mhos	1610	529	217	NA

Source: IMC 1993

Note:
- < Less than limit of detection
- 1 Spring locations shown on Map 3.4.
- 2 Average of two samples taken in 1992 and 1993
- 3 Does not meet state and federal drinking water standards
- NA Not Analyzed

Table 3.7, Continued
Water Quality of Springs and Seeps in the Jerritt Mine Expansion Analysis Area[1]

Parameter	Units	Niagara 11/19/92	GDSP-15 (Avg)[2]	MCDS-10 9/22/92	1 6/11/93	2 6/11/93
pH	pH units	7.56	7.74	7.96	6.73	6.65
Bicarb.Alk.	mg/l	247	307	184	NA	NA
Bicarb.Alk.	meq/l CaCO	NA	6.16	NA	4.46	3.18
Carb.Alk.	mg/l	NA	NA	NA	NA	NA
Cl	mg/l	6	5.55	67	2.5	3.3
SO_4	mg/l	47	27.2	1410[3]	14.7	20.3
NO_3	mg/l	0	0.275	36[3]	0.06	<0.05
NO_2	mg/l	NA	<0.05	NA	<0.05	<0.05
Na	mg/l	5.1	9.58	29.6	5.7	16.2
K	mg/l	1.3	0.8	6.8	1.1	0.7
Ca	mg/l	69.5	69.45	371	51.1	32.1
Mg	mg/l	29.5	35.95	220	26.1	18.3
Al	mg/l	NA	<0.02	NA	1.24	0.17
As	mg/l	0.025	0.0045	0.002	0.006	0.017
Ba	mg/l	NA	0.206	NA	0.297	0.143
Cd	mg/l	<0.01	<0.01	<0.01	<0.002	<0.002
Cr	mg/l	<0.06	0.006	<0.05	0.004	0.003
Cu	mg/l	<0.02	<0.02	<0.02	<0.004	<0.004
Fe	mg/l	0.05	0.162	0.14	1.63[3]	0.143
Pb	mg/l	<0.05	<0.05	<0.05	0.003	0.002
Li	mg/l	NA	<0.003	NA	<0.003	<0.003
Mn	mg/l	NA	0.005	NA	0.046	0.006
Hg	mg/l	<0.0005	<0.0004	<0.0005	<0.0002	<0.0002
Ni	mg/l	<0.04	<0.04	<0.04	NA	NA
Se	mg/l	<0.001	0.0005	0.002	<0.04	<0.04
Ag	mg/l	<NA	<0.002	NA	<0.002	<0.002
Zn	mg/l	<0.02	0.005	<0.02	0.019	0.004
F	mg/l	NA	<0.1	NA	<0.1	0.2
B	mg/l	NA	0.017	NA	<0.006	0.054
P	mg/l	NA	0.04	0.03	NA	NA
Si	mg/l	9	9.15	10	7.5	10.1
TDS	mg/l	386	345	2566[3]	216	183
Cond.	mhos	NA	603	NA	437	341

Source: IMC 1993

Note:
< Less than limit of detection
[1] Spring locations shown on Map 3.4
[2] Average of two samples taken in 1992 and 1993
[3] Does not meet state and federal drinking water standards
NA Not Analyzed

Table 3.7, Continued
Water Quality of Springs and Seeps in the Jerritt Canyon Mine Expansion Analysis Area[1]

Parameter	Units	3 6/11/93	4 6/11/93	5 6/18/93	6 6/18/93	7 6/18/93	8 6/17/93	9 6/17/93
pH	pH units	7.47	6.65	6.22	6.78	7.26	6.68	7.04
Bicarb. Alk.	mg/l	NA	NA	NA	NA	NA	NA	NA
Bicarb. Alk.	meq/CaCO	4.5	3.32	0.8	4.56	5.62	4.14	5.44
Carb. Alk.	mg/l	NA	NA	NA	NA	NA	NA	NA
Cl	mg/l	49.3	2.1	2	6.4	4.6	4	6.4
SO_4	mg/l	33.7	16.1	3.4	18.5	64.1	48.9	19.9
NO_3	mg/l	3.68	<0.05	0.64	2.86	0.18	<0.05	0.97
NO_2	mg/l	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Na	mg/l	6.28	8.67	2.01	3.2	11	10.8	10.5
K	mg/l	1	0.8	1.6	1.3	2.8	3	1.6
Ca	mg/l	69.3	54.9	13.5	62.4	82.5	57	60.6
Mg	mg/l	36.4	20.2	5.81	28.9	33.2	27.4	34.5
Al	mg/l	0.4	0.23	7.2	1.58	1.23	3.64	1.35
As	mg/l	<0.001	0.019	0.038	<0.001	0.016	0.015	0.007
Ba	mg/l	0.434	0.209	1.11	0.309	0.38	0.438	0.271
Cd	mg/l	<0.002	0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Cr	mg/l	0.003	0.004	0.006	<0.002	0.004	0.007	0.003
Cu	mg/l	<0.004	<0.004	0.016	<0.004	0.006	0.019	0.005
Fe	mg/l	0.427	0.632[3]	6.82[3]	1.89[3]	2.05[3]	5.24[3]	1.52[3]
Pb	mg/l	0.002	0.003	0.01	0.005	0.004	0.008	0.004
Li	mg/l	<0.003	<0.003	0.006	<0.003	<0.003	0.005	0.004
Mn	mg/l	0.028	0.038	0.18[3]	0.089	0.069	0.135[3]	0.059
Hg	mg/l	<0.0002	<0.0002	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
Ni	mg/l	NA	NA	NA	NA	NA	NA	NA
Se	mg/l	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
Ag	mg/l	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Zn	mg/l	0.115	0.026	0.051	0.026	0.023	0.055	0.034
F	mg/l	0.1	<0.1	<0.1	<0.1	0.2	<0.1	<0.1
B	mg/l	0.017	0.019	0.006	<0.006	0.048	0.034	0.017
P	mg/l	NA	NA	NA	NA	NA	NA	NA
Si	mg/l	9	7.6	15.4	8.2	12.3	14.3	8.3
TDS	mg/l	332	171	60	252	361	270	283
Cond.	mhos	648	333	97.9	477	626	484	540

Source: IMC 1993

Note: < Less than limit of detection
1 Spring locations shown on Map 3.4.
2 Average of two samples taken in 1992 and 1993
3 Does not meet state and federal drinking water standards
NA Not Analyzed

groundwater in equilibrium with limestone and dolomite. Values for pH ranged from 6.2 to 8.0, and TDS concentrations were between 60 to 386 mg/l. These springs generally meet primary and secondary drinking water and agricultural use standards, with the exception of secondary standards for iron and manganese.

Wetlands

Potential impacts to wetlands were identified as an issue for EIS analysis. The discharge of dredged or fill material into waters of the United States, which includes special aquatic sites such as wetlands, is regulated under Section 404 of the Clean Water Act. Wetlands serve a variety of functions, including wildlife habitat. The following discussion examines existing conditions for waters of the United States including wetlands within the Project area.

Wetlands within existing mine operations areas and within proposed expansion areas were delineated by IME Wetlands Consultants and Gibson & Skordal in 1992 (IMC 1992d, IME 1992, IMC & IME 1993). The objective of these studies was to delineate the extent of waters of the United States subject to Corps of Engineers (Corps) jurisdiction pursuant to Section 404 of the Clean Water Act. The studies evaluated the extent of all drainage channels satisfying the definition of "waters of the United States" as well as all adjacent and isolated jurisdictional wetlands.

Section 404 of the Clean Water Act requires that a Corps permit be obtained prior to discharging dredged or fill material into waters of the United States including associated wetlands. Waterbodies constituting "waters of the United States" include lakes, rivers, streams (including intermittent streams), mudflats, sandflats, wetlands, sloughs, prairie potholes, wet meadows, playa lakes, or natural ponds, the use, degradation, or destruction of which could affect interstate or foreign commerce (IMC & IME 1993). Wetlands are jointly defined by the Corps and EPA as those areas that are inundated or saturated at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs and similar areas (IMC & IME 1993).

All drainages within the study area were examined during the 1992 field investigation and a determination was made at each site whether waters of the United States, other than adjacent or isolated wetlands, were present. Estimated average widths of delineated drainage channels within the Project area ranged from one to ten feet (Gibson and Skordal 1992, IMC & IME 1993). The majority of waters delineated are in the upper reaches of the drainages and are ephemeral to intermittent with average widths of four to six feet (Gibson and Skordal 1992, IMC & IME 1993). Where springs or seeps occur in association with drainage channels, wetland vegetation is often present. No lakes or ponds were delineated within the areas studied. A number of small sediment traps which have been constructed downstream of active mine and exploration sites were delineated as impacted channels (IMC & IME 1993). Waters of the U.S. other than wetlands are displayed on the detailed maps in Appendix C.

Wetlands, both isolated and those adjacent to waters, were delineated using diagnostic environmental characteristics specified in the Corps manual. One wetland indicator for each parameter (hydrology, soil, and vegetation) must normally be found in order to make a determination that an area is a wetland (IMC & IME 1993). In the course of the field investigations, it was determined that the boundary of vegetation types dominated by certain hydrophytic plant associations coincided consistently with the boundaries of hydric soils. This correlation permitted mapping of wetland boundaries based on occurrences of hydrophytic vegetation.

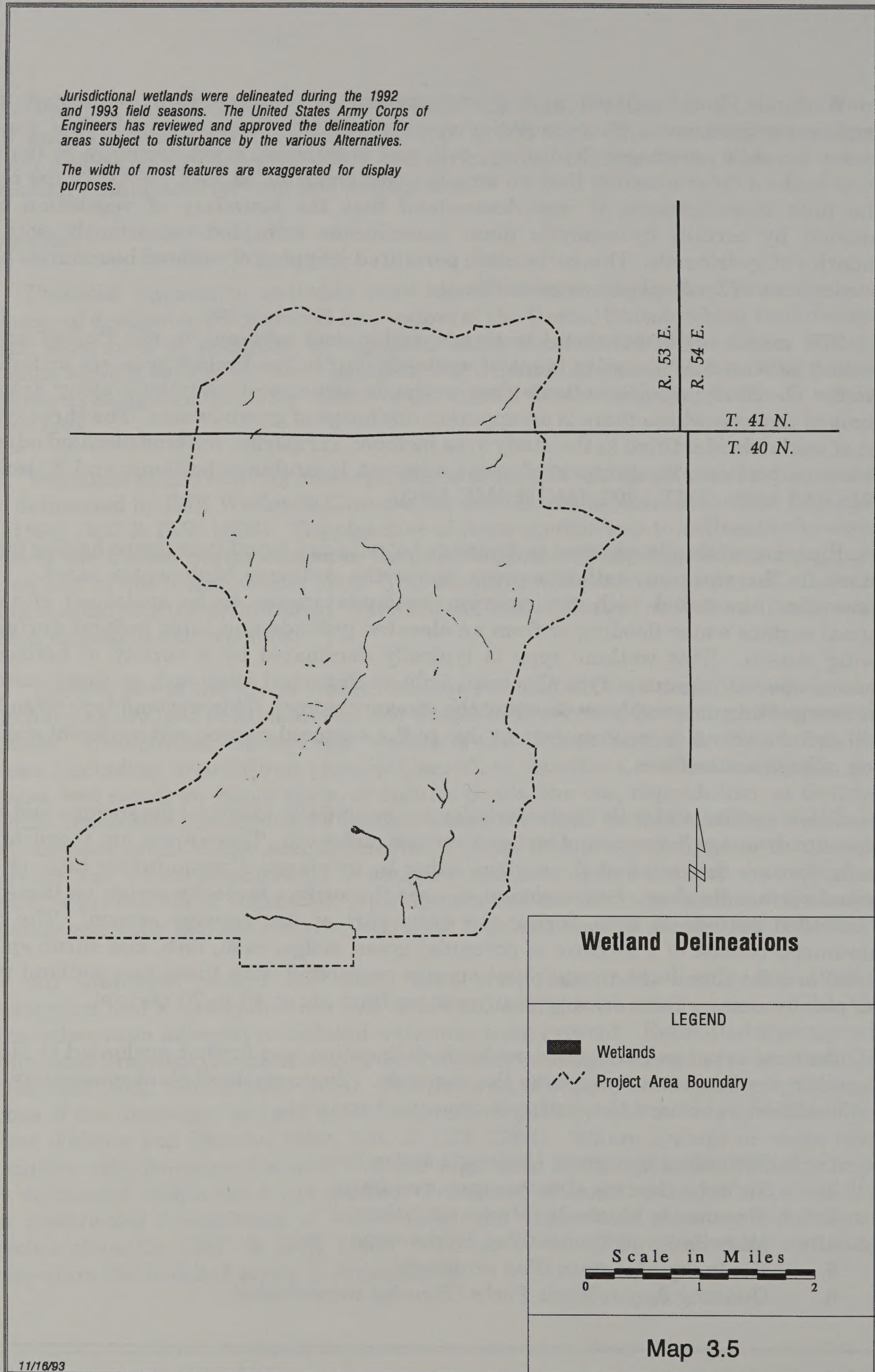
The extent of jurisdictional wetlands within and adjacent to the Project area is presented in Map 3.5. Detailed maps of wetlands within the Project area are included in Appendix C. Study results indicate that wetlands occur most commonly along drainage bottoms of canyons where there is an apparent discharge of groundwater. The three typical types of wetlands identified in the study area include: 1) riparian wetlands located adjacent to drainage bottoms; 2) springs and seeps adjacent to drainage bottoms; and 3) isolated springs and seeps (IME 1992, IMC & IME 1993).

Riparian wetlands adjacent to drainage bottoms are found in canyons having incised channels. The riparian wetlands occur above the ordinary high water mark. Plant communities associated with the riparian wetlands appear to be sustained either by seasonal surface water flooding or from an elevated groundwater table present during the growing season. This wetland type is typically dominated by a variety of herbaceous perennial species. Annuals typically occur only on disturbed sites such as those resulting from downcutting or lateral movement of the stream channel. This wetland type often lacks a well-defined shrub or tree component due to the seasonal nature and apparent scouring action of high water flows.

Plant species and soils characteristics are essentially identical for springs and seeps adjacent to drainage bottoms and isolated springs and seeps. These areas are characterized by soils that are saturated at the surface either by an elevated groundwater table or from seasonal surface flooding. Saturation at or near the surface typically occurs on these sites for extended periods of time during the early part of the growing season. The plant communities consist of a mixture of perennial grass, sedge, rush, forb, and shrub species. Willows are the dominant woody plant species associated with these two wetland types. Total plant cover on these sites typically ranges from about 40 to 70 percent.

Data collected as part of the wetlands delineation was further evaluated to identify the specific plant community types in the wetlands. Eleven wetland plant community types were identified in or near the wetlands types and streams.

1. Spreading bentgrass (*Argrostis stolonifera*)
2. Tufted hairgrass (*Deschampsia cespitosa*)
3. Streamside bluebells (*Mertensia ciliata*)
4. Miscellaneous Unclassified Herbaceous
5. Kentucky bluegrass (*Poa pratensis*)
6. Quaking Aspen/Mesic Forbs (*Populus tremuloides*)


Jurisdictional wetlands were delineated during the 1992 and 1993 field seasons. The United States Army Corps of Engineers has reviewed and approved the delineation for areas subject to disturbance by the various Alternatives.
The width of most features are exaggerated for display purposes.
R. 53 E.
R. 54 E.
T. 41 N.
T. 40 N.
Wetland Delineations
LEGEND
Wetlands
Project Area Boundary
Scale in Miles
0
1
2
Map 3.5
11/16/93

7. Sandbar willow (*Salix exigua*)
8. Geyer willow/Mesic Graminoids (*Salix geyerana*)
9. Yellow willow/Mesic Forbs (*Salix lutea*)
10. Yellow willow/Mesic Graminoids (*Salix lutea*)
11. False-Hellbore (*Veratrum californicum*)

Wetlands and waters of the U. S. have been affected by existing operations. Table 3.8 displays the existing and anticipated impacts as a result of currently approved operations. Mitigation for these impacts has been started and includes riparian and watershed enhancement, streambank stabilization, spawning habitat improvement, rest-rotation grazing, fencing to reduce grazing impacts, and wetland creation. Efforts are underway to provide additional mitigation for existing disturbance. These efforts are described in Chapter 4.

Table 3.8
Summary of Existing Impacts to Waters of the United States Including Wetlands

Location	Wetlands Existing Impacts (Acres)	Waters (Stream Channel) Existing Impacts	
		Acres	Linear Feet
Jerritt Canyon Mining Operation	0.934	0.510	6,901
Burns Basin Mining Operation	1.566	1.836	19,227
Winters Creek Mining Operation	1.048	0.047	685
California Mountain Mining Operation	0.025	0.131	2,075
TOTALS	**3.573**	**2.524**	**28,888**

Source: IMC, 1992b. Pre-Discharge Notification.

Note: Additional mitigation for existing impacts is being coordinated with the U.S. Army Corps of Engineers and is described in Chapter 4.

3.3 Biological Environment

Aquatic Resources and Fisheries

The issues associated with aquatic resources are primarily related to surface and ground water. Related issues include effects to any threatened, endangered, sensitive, or candidate fish species. The analysis area for aquatic resources is third order watersheds.

Physical Habitat Characteristics

The following information is based on a review of published literature, NDOW and USFS stream survey data, and surface water monitoring conducted by IMC. Available data pertinent to characteristics of stream channels within the Project area are from the habitat condition survey conducted jointly in 1978 by the USFS and NDOW, unless otherwise noted. Due to the dynamic nature of stream channels, existing conditions (average width, depth, velocity, etc.) may have changed since the 1978 survey.

<u>Jerritt Creek</u>

In September 1978, Jerritt Creek averaged less than three feet in channel width and less than 0.1 foot deep. The average gradient is approximately six percent and the average stream discharge was less than 0.01 cfs in the fall of 1978. The natural stream sediment load was determined to be fairly high.

Bank stability was described in 1978 as poor for Jerritt Creek and its tributaries with a 33 percent of optimum bank stability rating. Because of poor bank stability and low to intermittent stream flows, Jerritt Creek was rated a non-fishable water (USDA,USFS & NDOW 1978).

<u>Saval and Steer Canyons</u>

These two stream drainages are small ephemeral tributaries to Jerritt Creek with no fisheries potential. The drainage has an average depth of one inch, average width of 2.3 feet, and an average gradient of 7.2 percent (USDA, USFS and NDOW 1978).

<u>Burns Creek</u>

Burns Creek is characterized by moderate undercutting and sloughing with some ungulate trampling to the edge of the channel, causing an increase in siltation during high run-off. Average landform gradient next to the stream is approximately 18 percent. A portion of the stream channel in the upper reach is inundated by the Burns Basin waste rock dump and a sediment trap immediately downstream of the dump. Burns Creek averaged approximately 4 feet wide and 3 inches deep, with a volume of less than 1 cfs and an average stream gradient of 4.3 percent during September, 1978.

In 1978, bank stability was described as moderate for Burns Creek with a 68% of optimum bank stability rating. Because of moderate bank stability and perennial stream flows, Burns Creek was rated as a fishable water 0.9 miles above the Forest boundary from elevations of about 6,160 to 6,580 feet. The upper non-fishable intermittent reach was described as possessing severely sensitive banks. The vegetation in the headwaters of Burns Creek is predominantly sagebrush, while the lower (fishable) reach possessed good riparian vegetation and stream shade. The vegetation through this section is predominantly aspen, providing good bank stability.

Burns Creek was surveyed by NDOW in 1985. Between 1978 and 1985 bank stability decreased from 68% to 62% of optimum; pool riffle ratio dropped from 30% to 6%; pool quality dropped 100% to 0% of optimum; stream substrate composed of desirable sized material dropped from 72% to 53% of the substrate; and sedimentation of substrate increased from 12% to 47% of the substrate composition.

Sampling of stream channel characteristics was again conducted by the USFS in 1990. Some recovery of the stream has occurred through natural processes between 1985 and 1990. Desirable-sized materials had again increased to 80 percent of substrate, based on Wolmann pebble counts. Fine material had declined to 15 percent of the substrate. The 1990 substrate composition data do not reveal whether pools have been restored or if any quality pools have redeveloped since 1985.

Biological Characteristics

Macroinvertebrates are good biological indicators of disturbances to water quality and changes in physical habitat. The benthic macroinvertebrate fauna of the streams within the Project area consists largely of stonefly, caddisfly, mayfly, and truefly insects. In 1978, the species assemblages identified were largely indicative of well oxygenated clean water environments (USDA 1980). Detailed aquatic sampling results are presented in the Jerritt Canyon FEIS aquatic biology technical report (ERT 1979f). In 1985 NDOW conducted macroinvertebrate sampling in Burns Creek. This sampling showed moderate amounts of sediment present (Ramsey 1994).

Drainages in the Project area that flow to the west include Burns Creek, Mill Creek, and Jerritt Creek and its tributaries, Saval and Steer Creeks. All of these except Burns Creek are ephemeral or intermittent and do not sustain reproducing fish populations within the Project area, though trout exist in the lower reaches of Jerritt Creek, outside of the Project area (USDA, USFS & NDOW 1978). The trout in Burns Creek are discussed under the section on wildlife.

Vegetation

The primary issues associated with the vegetation resources of the Project area include: 1) the potential for threatened, endangered, candidate, or sensitive plant species to be affected; 2) effects to vegetative diversity; and 3) aspen fragmentation.

The regional vegetation in the Independence Mountains consists of a combination of the Great Basin sagebrush type and the sagebrush steppe that occurs further north (Kuchler 1975). At the higher elevations there are areas of Great Basin pine forest and subalpine fir forest. The majority of the general study area and the Project area is composed of a mosaic of sagebrush grasslands, mountain brush, and aspen.

Vegetation in the Independence Mountains was mapped by the USFS in 1986 using ECODATA sampling methods described in the *Ecosystem Classification Handbook* (USDA, USFS 1987) and GIS. ECODATA mapping of the general study area and the Project area

was field verified and refined by WESTEC botanists in the early fall of 1992 and summer of 1993. The ECODATA sampling method defines the dominant vegetation types that occur within an area based on the two or three dominant plant species present. For the Independence Mountains, 74 vegetation dominance types were delineated and mapped. During the 1992 and 1993 field surveys, the dominance types and boundaries between types were verified and new data was collected on aspen and wet meadow sites. Existing impacts to vegetation resources were determined using the CEA, and include Forest Service roads and trails, mineral exploration roads, and mining disturbances.

Threatened, Endangered, Candidate, and Sensitive Plants

A literature search and partial field survey were conducted in 1992 by JBR Consultants Group (JBR) to determine if threatened, endangered, candidate, or sensitive plant species occur or potentially occur in and near the Project area. A list of threatened, endangered, candidate and sensitive plant species potentially occurring within the Project area and general study area was prepared by IMC and JBR in cooperation with the USFS, NDOW, BLM, and USFWS. This list was verified in consultation with the USFWS in December, 1993.

Habitat requirements for threatened, endangered, candidate and sensitive species in terms of soils, geologic setting, associations with other plants, and other aspects were used to identify areas of potential habitat within the Project area and general study area. This information was used during site specific field studies conducted in early summer of 1993. The 1993 survey was conducted at the phenologically appropriate time and concentrated on areas where potential habitat for the threatened, endangered, candidate and sensitive plant species occurred within the Project area. Field verification of the presence or absence of these plant species or their habitats was also conducted during refinement of the vegetation mapping in 1992 and 1993.

In January of 1994, two additional candidate plant species were identified by the Department of the Interior as occurring or potentially occurring in and near the Project area. Surveys for these two species have not been conducted to date. Surveys for these species may be done by the USFS in 1994.

Threatened and Endangered Species

The literature reviews and field surveys did not identify any threatened or endangered plant species or their habitat that occur or may potentially occur in the Project area.

Candidate and Sensitive Species

The USFWS candidate species that are a concern for the Project are classified in Categories 2 or 3. Species in Category 2 may warrant listing as threatened or endangered in the future, but sufficient biological information to support listing is lacking. Category 3 species are those taxa that once were considered for listing as threatened and endangered

but are no longer under such consideration. Category 3 is subdivided into several subcategories. Subcategory 3C species are those species that were found to be more abundant or widespread than previously believed and/or those that are not subject to any identifiable threat.

Sensitive species are a USFS classification that pertains to those plants for which population viability is a concern. This is evidenced by: 1) a significant current or predicted downward trend in population numbers or density, or 2) a significant current or predicted downward trend in habitat capability that would reduce the species' existing distribution. Plants listed as Category 2 or 3 in the Project area are also included on the USFS' list of sensitive species and are discussed below with candidate species.

The Northern Nevada Native Plant Society (NNNPS) maintains a list of species for which population viability is a concern. Two species are included on the threatened, endangered, candidate and sensitive species list for the Project area that also fall in two NNNPS categories: 1) watch species, potentially vulnerable taxa in need of monitoring or further data to determine status, and 2) species deleted from consideration by NNNPS because they are presently considered secure, taxonomically indistinct, or for other reasons. These species are also included in the USFWS and USFS classifications discussed above.

The following is a description of those Category 2 and 3 and sensitive species that have the potential to occur in or near the Project area.

Habitat for Lewis' buckwheat (*Eriogonum lewisii*), a USFWS Category 2, USFS sensitive species and NNNPS watch list species, occurs on exposed rocky ridges with low sagebrush (*Artemisia arbuscula*) at elevations above 7,800 feet in northern Elko County, Nevada. The nearest documented population of Lewis buckwheat occurs approximately 1,000 feet east of the Project area. Intensive field surveys within the Project area on sites with potential habitat for Lewis' buckwheat in 1993 did not reveal additional populations beyond those mapped outside of the Project area in 1992.

Meadow pussytoes (*Antennaria arcuata*) is classified as a USFWS Category 2, USFS sensitive, and NNNPS watch list species. It is a composite and a member of the Sunflower or Asteraceae Family. Potential habitat includes small, bare or lichen-covered spots of soil in sedge-grass meadows and the edges of wild hay meadows that are not permanently wet. This species is found at elevations between 5,250 and 6,400 feet. The nearest documented population of meadow pussytoes is approximately nine miles southeast of the Project area in the vicinity of Gance Creek. Habitat for meadow pussytoes is unlikely to occur in the Project area because the elevations are typically higher than those at which this species occurs. This species was not found within the Project area or surrounding areas during the field surveys.

Howell dimersia (*Dimersia howellii*) is a USFS sensitive species. It has been deleted from consideration by the NNNPS because it is presently considered secure. This annual plant is a member of the Sunflower Family and is currently known to occur in parts of Elko, Humboldt, Lander, and Washoe counties, Nevada, as well as in parts of California, Idaho,

and Oregon. Its known habitat is foothills and low mountains on dry gravelly soil, mostly volcanic in nature. The species occurs in association with sagebrush (*Artemisia spp.*) and has been reported in the southern Independence Mountains. The nearest documented occurrence of this species is approximately 5 miles from the Project area in the vicinity of Gance Creek. This plant species was not found within the Project area during the field surveys.

Broad fleabane (*Erigeron latus*) is a USFWS Category 2, USFS sensitive, and NNNPS watch list species. This perennial plant is a member of the Sunflower Family and is known to occur in Elko County, Nevada and Owyhee County, Idaho. It occupies thin or gravelly soil or rocky hillsides and outcrops of volcanic origin at elevations ranging from 5,200 to 6,700 feet. Associated species include *Artemisia*, *Haplopappus*, *Eriogonum* and *Phoenicaulis*. The nearest documented occurrence of broad fleabane is located approximately four miles southeast of the Project area. It is unlikely that potential suitable habitat for broad fleabane occurs in the general study or Project areas due to the lack of volcanic rocks in the area. Surveys for broad fleabane within the Project area during 1992 and 1993 did not reveal the presence of this species.

Grimes vetchling (*Lathyrus grimesii*) is a Category 2 species. It has been petitioned for listing as an endangered species. The closest known locality of this is approximately ten miles north of the Project area, in the Jacks Creek area. The grimes vetchling was not observed within the Project area during the 1992 and 1993 plant field surveys, nor in earlier USFS plant surveys (Lake, pers. comm., June 1993). Recent surveys for this plant in the Jacks Creek area by the USFS and IMC revealed that it is more widely distributed than originally thought.

Leiberg clover (*Trifolium leibergii*) is a USFWS Category 2 species and NNNPS watch list species. It occurs on bare, shaley crests and talus slopes at elevations between 6,500 and 8,000 feet. It is currently known to occur in the Independence Mountains, Jarbidge Mountains and in southern Oregon. The nearest known population is approximately ten miles north of the Project area in the vicinity of Jacks Creek. This plant species was not surveyed for during the 1992 and 1993 surveys.

Least phacelia (*Phacelia minutissima*) is a rare plant listed as a USFWS Category 2 species and is included in the NNNPS list of threatened species. The least phacelia was first published as a Category 2 species on September 30, 1993. It occurs on gravelly soils on northern aspects, slopes vegetated with mountain brush to sunny flats at elevations between 6,000 and 7,800 feet. Its known distribution in Nevada includes Gold Creek and Stump Creek in Elko County. The Stump Creek population is along a dry creek bed and is within one half mile of the Project area. This plant species was not surveyed for during the 1992 and 1993 surveys.

Vegetative Diversity

Vegetative diversity in the Project area is in part a function of the distribution and species composition of plant communities in the analysis area, and is described here in terms of the community types defined for the area.

The 74 vegetation dominance types mapped in the Project area have been grouped into ten community types in this analysis. Community types are defined in the USFS ECODATA Handbook as areas in which the dominant and/or indicator plant species are similar. Community types have also been defined as an assemblage of populations of plants in a common spatial arrangement (USDA, USFS 1993c). The community types were defined in terms of their extent and distribution as well as average canopy cover heights. Canopy heights were calculated from the average of all stems, including saplings, in the understory and overstory. The ten community types, listed in order of abundance are: sagebrush/grasslands, aspen (mature aspen and snowbank aspen), north-facing mountain brush, sagebrush/snowberry, low sagebrush/grasslands, south-facing mountain brush, herbaceous meadows, riparian, snowbank forb, and subalpine fir/pine (See Table 3.9 and Map 3.6).

Sagebrush/Grassland

The sagebrush/grassland community type occurs primarily on terrace deposits, alluvial fans, volcanic uplands, and along stream bottoms. This community type is dominated by sagebrush species (*Artemisia sp.*). It intergrades extensively with the sagebrush/snowberry, north-facing mountain brush, and aspen community types on cooler, moister exposures, and with low sagebrush/grasslands and south-facing mountain brush along ridgelines and on drier sites. The sagebrush/grassland community type occupies approximately 4,711 acres (43 percent) of the Project area and approximately 20,421 acres (46 percent) of the general study area. Previous disturbance of the sagebrush/grassland community type totals 1,239 acres within the Project area.

Aspen

The aspen community type occurs primarily on north-facing slopes above 6,000 feet and on sites with high soil moisture. Stands of aspen (*Populus tremuloides*) are located near springs, along drainages, and in the canyon bottoms adjacent to the riparian zones. This community type is important to wildlife and livestock due to the multiple vegetative layers and the thermal and visual cover afforded by the structural nature of the vegetation.

ECODATA distinguishes two aspen dominance types, snowbank and mature. The snowbank dominance type is analyzed separately from other larger (mature) aspen dominance types because it is structurally very different in size of mature trees, density of trees, canopy cover, and wildlife/livestock use. The growth form of the snowbank aspen is brushy, dense, and low in stature. The snowbank aspen type was estimated to have 90 percent canopy cover with an average height of 6 feet and diameter-at-breast-height (dbh)

Table 3.9
Vegetation Types in the Project and General Study Area (Existing Conditions)

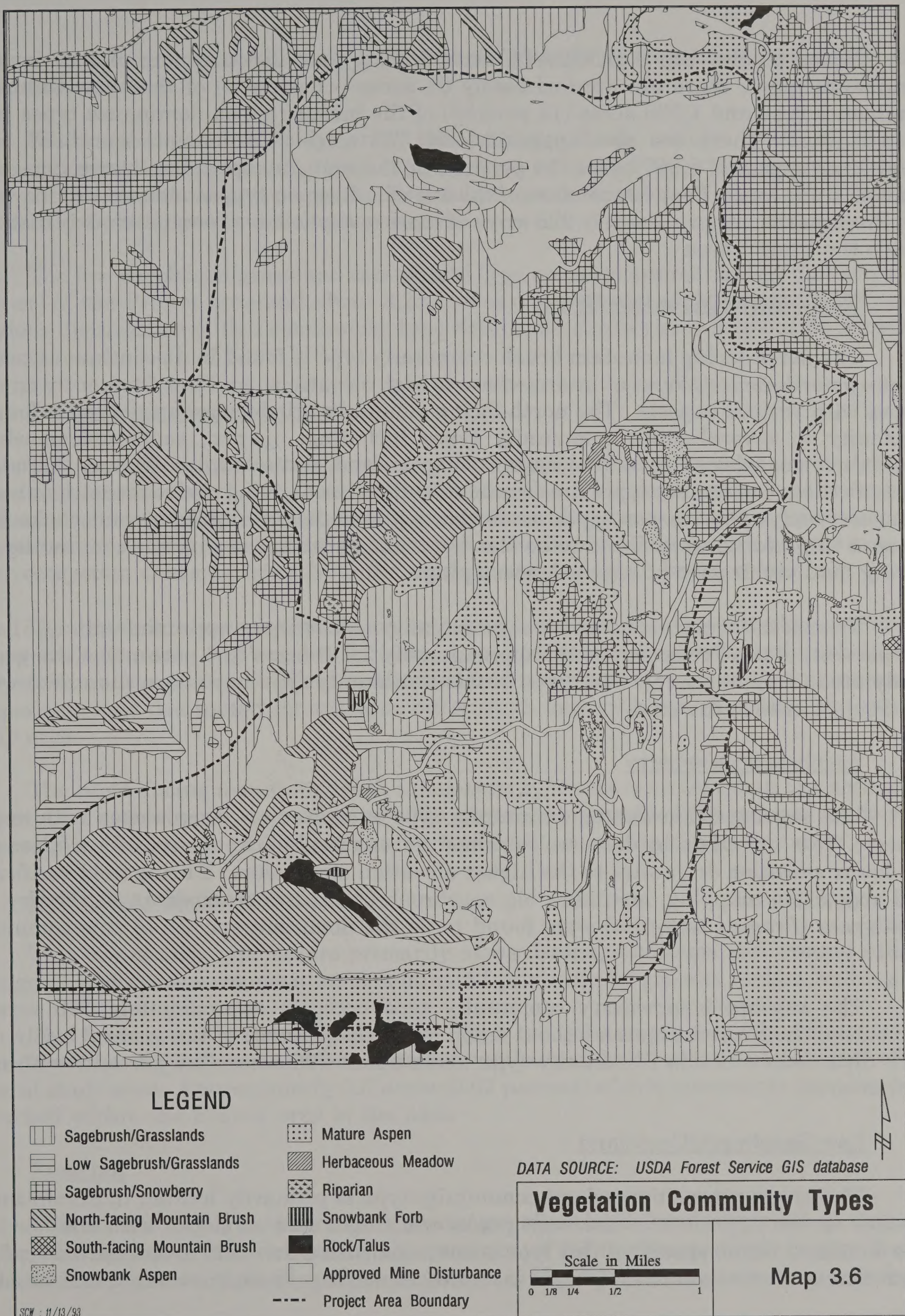
Type	Project Area		General Study Area	
	Acres	%	Acres	%
Sagebrush/Grasslands	4,711	43.4	20,421	46.4
Aspen				
Mature Aspen	1,538	14.2	5,967	13.5
Snowbank Aspen	61	0.6	528	1.2
North-Facing Mountain Brush	1,331	12.3	2,913	6.6
Sagebrush/Snowberry	546	5.0	6,855	15.6
Low Sagebrush/Grasslands	375	3.5	3,253	7.4
South-Facing Mountain Brush	0	0.0	234	0.5
Herbaceous Meadow	34	0.3	40	0.1
Riparian	31	0.3	286	0.6
Snowbank Forb	10	0.1	44	0.1
Subalpine Fir/Pine	0	0.0	6	0.0
Rock/Talus	79	0.7	290	0.7
Disturbance[1]	2,131	19.7	3,137	7.1
Total[2]	**10,849**	**100.0**	**44,055**	**100.0**

Source: USFS GIS Data - June 1993.

Note: [1] Disturbance includes existing/approved mining disturbance, exploration disturbance, USFS roads, etc.
[2] Total includes an 82 acre (0.2%) disjunct USFS parcel included in the General Study Area which was not surveyed for vegetation.

of 2 inches. The snowbank aspen dominance type typically occurs on steep, windblown and snow-deposited slopes.

Mature aspen are divided into five dominance types, all with mature growth form and structural characteristics which distinguish them from the snowbank aspen type. The five mature aspen dominance types in the Project area were estimated to have 65 percent aspen canopy cover and 38 percent shrub canopy cover. The average height of the mature aspen was 15 feet, and the dbh was 5 inches.


LEGEND
Sagebrush/Grasslands
Low Sagebrush/Grasslands
Sagebrush/Snowberry
North-facing Mountain Brush
South-facing Mountain Brush
Snowbank Aspen
Mature Aspen
Herbaceous Meadow
Riparian
Snowbank Forb
Rock/Talus
Approved Mine Disturbance
Project Area Boundary
SCW : 11/13/93
DATA SOURCE: USDA Forest Service GIS database
Vegetation Community Types
Scale in Miles
0 1/8 1/4 1/2 1
Map 3.6

Based on the USFS ECODATA classification and GIS mapping of the six aspen dominance types, there are approximately 61 acres (<1 percent) of the snowbank aspen dominance type and 1,538 acres (14 percent) of the mature aspen dominance types in the Project area. There are also approximately 528 acres (1.2 percent) snowbank aspen dominance type and 5,967 acres (14 percent) of the mature aspen dominance type in the general study area. Past disturbance of the snowbank aspen type is about 8.7 acres within the Project area. Approximately 326 acres of mature aspen have been previously disturbed inside the Project area.

North-facing Mountain Brush

The north-facing mountain brush community type is found in discontinuous patches on steep north-facing slopes at intermediate to high elevations, and less frequently on rocky slopes with various aspects. The north-facing mountain brush community type is found in proximity to several other community types including: aspen, sagebrush/snowberry, riparian, low sagebrush/grassland, sagebrush/grassland, and subalpine fir/pine. Boundaries between these community types are occasionally indistinct, giving rise to transitional areas. Snowberry (*Symphoricarpos spp.*), serviceberry (*Amelanchier alnifolia*) and chokecherry (*Prunus virginiana*) were found to be the dominant shrub species in this community type during field verification of vegetation mapping.

The north-facing mountain brush community type occupies approximately 1,331 acres (12 percent) of the Project area and approximately 2,913 acres (6.6 percent) of the general study area. Approximately 211 acres of this community type have been disturbed within the Project area in the past.

Sagebrush/Snowberry

The sagebrush/snowberry community type is located on steep slopes with various aspects. It is underlain by deep, well-drained soils and exhibits substantial variation from the lower elevation drier sites to the higher elevation mesic sites. During field verification and vegetation mapping, mountain big sagebrush (*Artemisia tridentata)*, snowberry, and cheatgrass (*Bromus tectorum*) were found to be the dominant species in this community type.

The sagebrush/snowberry community type occupies approximately 546 acres (5 percent) of the Project area and about 6,855 acres (16 percent) of the general study area. Past disturbance of this community type totals about 296 acres (2.7 percent) within the Project area.

Low Sagebrush/Grassland

The low sagebrush/grassland community type is primarily located in discontinuous patches on the uppermost windswept peaks and ridges and on slopes with shallow soils. The dominant shrub species of this type is low sagebrush (*Artemisia arbuscula*). It is found in proximity to a few community types including aspen, sagebrush/snowberry, and subalpine

fir/pine. Boundaries are occasionally indistinct and give rise to transitional areas with other community types.

Within the general study area, the average shrub canopy cover of the low sagebrush/grassland community type sampled was estimated to be 40 percent. Ground cover in this community type typically exhibits good diversity of vegetation, but the continuity of plant species distribution is poor.

The low sagebrush/grassland community type occupies approximately 375 acres (3.5 percent) of the Project area and about 3,253 acres (7.4 percent) of the general study area. Previous disturbance of this community type within the Project area is about 34 acres (0.3 percent).

South-facing Mountain Brush

The south-facing mountain brush community type is located on steep southerly facing slopes and is underlain by shallow well drained soils. This community type is found in proximity to sagebrush/grassland and riparian community types along the lower slopes of canyon bottoms. This type differs significantly in dominant plant species composition and other ecosystem characteristics from the north-facing mountain brush community type.

Dominant shrub species in this community type include antelope bitterbrush (*Purshia tridentata*), mountain big sagebrush (*Artemisia tridentata vaseyana*), and rabbitbrush (*Chrysothamnus nauseosus*). Field verification and mapping determined that plant species composition was dominated by antelope bitterbrush and rabbitbrush within the general study area.

The south-facing mountain brush community type occurs on less than one acre in the Project area and occupies approximately 234 acres (0.5 percent) of the general study area. No previous disturbance of this community type has occurred in the Project area.

Herbaceous Meadow

This community type occurs primarily along drainage bottoms and around hillside springs. Plant species composition is dominated primarily by grasses, sedges and rushes.

The herbaceous meadow community type occupies approximately 34 acres (0.3 percent) of the Project area and accounts for approximately 40 acres (0.1 percent) of the general study area. Approximately 2.7 acres (0.02 percent) of this community type has been disturbed within the Project area in the past.

Riparian

This community type occurs along drainages of perennial and intermittent streams, and around springs. It is defined by the presence of taller phreatophytic (water loving) shrub and tree species, typically willow (*Salix spp.*). The riparian community type is found

in close proximity to several community types including aspen, wet meadow, north-facing mountain brush, south-facing mountain brush, and sagebrush/snowberry.

The average shrub canopy cover of the riparian communities sampled in the general study area was estimated to be 51 percent. Willow and chokecherry contributed the most extensive cover. Shrub heights were relatively tall, averaging from 6 to 8 feet, and average dbh was 5 inches. Because of the availability of water, forage, and shade typically associated with the riparian communities, this is one of the most important community types in the Project area for indigenous wildlife and livestock.

The riparian community type occupies approximately 31 acres (0.3 percent) of the Project area and accounts for approximately 286 acres (0.6 percent) of the general study area. Approximately 1.6 acres (0.01 percent) of this community type have been disturbed within the Project area in the past.

Snowbank Forb

The snowbank forb community type is a stunted form of forb-dominated vegetation found in small pockets where snowmelt occurs later than the surrounding areas. These isolated pockets have shallow, well-drained soils and lack shrub and sagebrush vegetation due to the presence of saturated soils for long periods of time. The dominant species that are found in this community type include needlegrass (*Stipa spp.*) and silvery lupine (*Lupinus argenteus).* This community type occupies approximately 10 acres (0.1 percent) of the Project area and 44 acres (0.1 percent) of the general study area. Past disturbance of this community type totals about 1.4 acres (0.01 percent) within the Project area.

Subalpine Fir/Pine

The subalpine fir/pine community is located on steep slopes at higher elevations. Subalpine fir (*Abies lasiocarpa*) is found entirely on the steep north-facing slopes of the highest peaks of the Independence Mountain Range. Pines found within this community type are whitebark pine (*Pinus albicaulis*), found at elevations as low as 7,750 feet, and a few scattered limber pine (*Pinus flexilis*) in the Jacks Peak area north of the general study area (Loope, 1969). They are found on various aspects in the same vicinity as the fir, and often growing with the fir. This community type commonly occurs in areas of moderately deep, well-drained soils. It is found in proximity to aspen, sagebrush/snowberry, low sagebrush/grassland, and north-facing mountain brush community types.

The subalpine fir/pine community type occupies less than one acre (<0.1 percent) of the Project area and approximately 6 acres (<0.1 percent) of the general study area. The subalpine fir/pine community type has not been previously disturbed within the Project area.

Aspen Habitat Fragmentation

Aspen habitat fragmentation was identified as an issue during interagency scoping for the proposed Project. Aspen was identified as a key community type in the Independence Mountains during development of the CEA analysis for several reasons: 1) aspen provide unique habitat characteristics for wildlife species; 2) aspen communities and flora and fauna that utilize them are in greater need for management emphasis because there is no "pool" of plants and wildlife species in the area for colonization; and 3) aspen play key roles in the migration of most wildlife species from area to area in the Independence Mountains (USDA, USFS 1992a). Aspen habitat is relatively rare throughout Nevada. Aspen vegetation is estimated to cover approximately 330,139 acres in Nevada, or less than 0.5 percent of the total area of the state (Born et al, 1992).

Aspen habitat fragmentation is a function of the distribution and distance between the stands. The relationship between the larger stands and smaller "steppingstone" stands which allow for the movement of plants and animals is also an important consideration.

Aspen habitat in the Project area generally occurs in a naturally fragmented state, as shown on Map 3.6. Small aspen stands occur widely scattered throughout the northern portion of the Project area and occur in the vicinity of springs and along drainages. In the Saval and Steer and Burns Basin mine areas, several large interconnected aspen stands occur on north-facing slopes and along canyon bottoms. These stands typically contain openings with other community types. They have been locally fragmented into smaller stands by existing disturbance.

The CEA province for analysis of effects to aspen habitat is third order watersheds in the Project area. Within the Jerritt Canyon watershed, approximately 132 acres (14 percent) of the 921 acres of aspen in the watershed have been previously disturbed. In the Burns Creek watershed, approximately 194 acres (14 percent) of the 1,359 acres of aspen in the watershed have been previously affected.

Approximately 335 acres (17 percent) of the 1,934 acres of aspen present in the Project area prior to mining have been previously disturbed. The existing area of 1,599 acres of aspen in the Project area is displayed in Table 3.9. Approximately 583 acres (8 percent) of the 7,078 acres of aspen present in the general study area prior to mining have been previously disturbed. The existing area of 6,495 acres of aspen in the general study area is displayed in Table 3.9.

Other Issues Related to Vegetation

Wetlands

Wetlands and other jurisdictional waters of the U.S. were delineated during field surveys conducted in 1992 throughout the Jerritt Canyon mine area (discussed under wetlands and waters of the United States). The wetlands were delineated using diagnostic vegetation, soils, and hydrology characteristics specified in the 1987 Corps of Engineers

Delineation manual. During the field investigations it was determined that the boundary of wetland areas corresponds closely with the boundary of hydrophytic vegetation. Wetland areas in the Project area were therefore delineated on the basis of several plant community types defined using the USFS Riparian Type Classification System (IMC and IME 1993). These plant community types correspond in part to the herbaceous meadow and riparian community types defined using the ECODATA system.

Reclamation Potential

Interim, concurrent and final reclamation has been ongoing in areas disturbed by existing mining operations. Interim reclamation efforts have established vegetative cover in areas that would be disturbed again, such as haul road cut slopes, growth medium stockpiles, oand other areas. Final and concurrent reclamation of mine waste dumps and portions of mined-out pits, including revegetation of partial pit backfill areas, is underway and additional final reclamation would be performed as mining progresses. Approximately 194 acres of disturbance designated for final reclamation have been reseeded (IMC 1994). Most disturbed areas are currently being mined or have been mined recently and limited amounts of final reclamation have been possible.

Wildlife

The primary issues associated with wildlife include potential effects to the following: 1) endangered, threatened, candidate, or sensitive species, 2) goshawk *(Accipiter gentilis)* habitat, 3) mule deer *(Odocoileus hemionus)* habitat, 4) sage grouse *(Centrocereus urophasianus)* brooding habitat, 5) golden eagles (*Aguila Chrysaetos*), and 6) upland game birds, furbearers, and trout. Related issues include effects to other wildlife species and aspen habitat fragmentation.

The description of the existing environment for wildlife in the Project area is based on a combination of field surveys and literature reviews, plus assumptions derived from the vegetative communities described under vegetative diversity. When wildlife habitat is based on plant communities instead of actual observations, it is referenced throughout this document as potential habitat.

Many of the wildlife resources within the Project area were evaluated using a system of resource value ratings (RVR's). The RVR's were established during development of the CEA and are based upon literature reviews and local knowledge of specific wildlife habitat characteristics. Specifically, RVR's have been established for northern goshawks, mule deer habitat, sage grouse brooding habitat, blue grouse (*Dendragapus obscurus*) habitat, beaver *(Castor canadensis)* habitat, and cavity nester habitat. Habitat attributes are used to determine value to wildlife species rather than relying on wildlife sightings. Existing impacts to wildlife habitat are determined using the CEA and include Forest Service roads and jeep trails, exploration roads, and mining disturbances.

Endangered, Threatened, Candidate, and Sensitive Species

A literature search was conducted in 1992 by JBR Consultants Group (JBR) to define the habitat requirements and determine if endangered, threatened, candidate (Category 2 or C2), or sensitive animal species occur or potentially occur in the Project area. A list of those animal species which may occur within the general study and Project areas was prepared by IMC and JBR in cooperation with the USFS, NDOW, BLM, and USFWS. The list of threatened, endangered, candidate and sensitive species potentially occurring within the Project area is provided in Table 3.10. This list was verified in consultation with the USFWS between the DEIS and FEIS.

Field surveys designed to determine whether these species or their habitats potentially occur within the Project area were conducted in 1992 and 1993. The information obtained from the literature review and field surveys is summarized in the following sections.

Endangered Species

The USFWS endangered species classification pertains to any species which is in danger of extinction throughout all or a significant portion of its range. Bald eagles (*Haliaeetus leucocephalus*) and peregrine falcons (*Falco peregrinus anatum*), are the only species listed as endangered that have the potential to occur within the Project area. Bald eagles are annual winter visitants in Nevada and peregrine falcons are residents in Nevada. Bald eagles may pass through the Project area in winter, as evidenced by sightings in valleys adjacent to the Independence Mountains, but do not nest in the Project area. Peregrine falcons have not been seen in or near the Project area, but may pass through the area on their way to other locations.

Threatened Species

The USFWS threatened species classification pertains to any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range. Lahontan cutthroat trout (*Oncorhynchus clarki henshawi*) is the only species listed as threatened that has the potential to occur in the vicinity of the Project area. This species occurs outside of the Project area on the east side of the Independence Mountain Range, in the area of a haul road used to bring ore off the Jerritt Canyon Project mine to the existing mill site. This habitat has been analyzed in previous documents. Modifications to the approved POO for the Jerritt Canyon Project addressing drainage and sediment control along the mine to mill haul road were evaluated in 1993 by the USFS and NDEP to protect surface resources, including Lahontan cutthroat habitat. Consultation with the USFWS regarding this modification occurred prior to approval.

Candidate (Category 2) Species

During the NEPA process, the USFWS provided a list of candidate species that may be present in the area. The candidate species are currently being reviewed by the USFWS

Table 3.10
Threatened, Endangered, Candidate, Sensitive and Management Indicator Species Occurring or Potentially Occurring Within the Project Area

Species	Category	
	USFWS[1]	USFS[2]
Mammals		
Western Big-Eared Bat	2	S
Spotted Bat	2	S
Preble's Shrew	2	-
Sierra Nevada Red Fox	2	-
Lynx	2	S
Pygmy Rabbit	2	-
Mule Deer	-	MIS
Birds		
Bald Eagles	E	-
American Peregrine Falcon	E	-
Northern Goshawk	2	S/MIS
Flammulated Owl	-	S
Loggerhead Shrike	2	-
White-Faced Ibis	2	-
Sage Grouse	-	MIS
Fish		
Redband Trout	2	-
Trout Species	-	MIS
Amphibians		
Spotted Frog	2	S
Invertebrates		
Mattoni's Blue Butterfly	2	-

Source: JBR Consultants Group, 1993b.

Note: [1] USFWS (U. S. Fish & Wildlife Service) Categories:

E = Endangered Species - any species which is in danger of extinction throughout all or a significant portion of its range.

T = Threatened Species - any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

2 = Candidate, Category 2 Species - taxa which may warrant listing as threatened or endangered, but for which sufficient biological information to support a rule to list is lacking.

[2] USFS (U. S. Forest Service) Categories:

S = Sensitive Species - species identified by the Regional Forester for which population viability is a concern, as evidenced by: (1) significant current or predicted downward trend in population numbers or density, or (2) a significantly current or predicted downward trend in habitat capability that would reduce the species' existing distribution.

MIS = Management Indicator Species - Species selected by the USFS for one or more of the following reasons: (1) they are economically and socially important, (2) they are readily monitored and have high visibility and adequate numbers, (3) they are found in all areas of the Forest, (4) they are somewhat representative of all wildlife species which use a particular vegetative type, (5) they are sensitive to changes in habitat and act as a barometer of the condition and trend of vegetative types, and (6) specific vegetative types provide key habitat for the species during its life cycle.

and are under consideration for possible listing as endangered or threatened. Candidate species are included here for consideration as it is possible that one or more could be proposed and listed before the project is completed. USFWS Category 2 species that are also listed as sensitive by the USFS are also discussed in this section. The following is a description of those Category 2 species that occur or have the potential to occur in or near the Project area.

Preble's shrew (*Sorex preblei*) is a Category 2 species that occurs in marshy areas such as creeks and bogs bordered by willows and other woody plants, in moist or dry woodlands, and occasionally in wetter areas of open conifer tree stands and montane sagebrush communities. The nearest known sighting of this species occurred at approximately 6,500 feet in elevation about four miles east of the Project area in 1984 (JBR, 1993a). Potential habitat for Preble's shrew may be present along drainages at the lower elevations within the Project area.

Pygmy rabbit (*Brachylagus idahoensis*) is a Category 2 species that occurs in relatively dense and tall sagebrush, greasewood communities, dense stands of rabbitbrush, and on floodplains dominated by rabbitbrush. The nearest known documented sighting of pygmy rabbits occurred about four miles east of the Project area at lower elevations. This species was not observed during the 1992 and 1993 field surveys within the Project area, but potential habitat may exist at the lower elevations.

Sierra Nevada red fox (*Vulpes vulpes necator*) is a Category 2 species that dens in natural rock cavities and holes in the ground. This species hunts rodents and insects in openings and meadows within coniferous forests (JBR 1993b). No Sierra Nevada red fox were observed during the field surveys of the Project area and it is unlikely that this species occurs in the Independence Mountains (JBR 1993a).

Lynx (*Felis lynx canadensis*) is a Category 2 and USFS sensitive species that generally occurs in boreal forests, clearings, bogs, thickets, and rocky outcrops (JBR, 1993b). Denning occurs in mature forest stands. The most recent records for lynx in Nevada date to the 1890s, when lynx were reported to be present in the Jarbidge and Owyhee areas (JBR 1993b). It is therefore unlikely that lynx inhabit the Independence Mountains and none was observed during the field surveys of the Project area.

Western big-eared bat (*Plecotus townsendii*) is a Category 2 and USFS sensitive species that roosts in caves, inactive mine shafts, rock outcrops, and old buildings. This bat species occurs in juniper-pine forests, shrub-steppe grasslands, deciduous forests, and mixed coniferous forests from sea level to 10,000 feet in elevation (JBR 1993b). Mist net surveys conducted during 1980, 1981, 1991, and 1992 within the Independence Mountains did not reveal the presence of western big-eared bats (McAdoo, 1981; USFS files; NDOW files; JBR 1993a).

Spotted bat (*Euderma maculatum*) is a Category 2 and USFS sensitive species that occurs in a variety of habitats including open ponderosa pine, desert scrub, pinyon-juniper, and open pasture and hay fields (JBR 1993b). This bat species roosts in rock crevices high

up on steep cliff faces. No occurrences of spotted bats have been reported from northeastern Nevada (JBR 1993a).

Because both bat species rely heavily on water sources for both watering and food, isolated ponds within the Project area are potential habitat.

Loggerhead shrike (*Lanius ludovicianus*) is a Category 2 bird species that is typically associated with greasewood and sagebrush communities (JBR 1993b). This species also occurs in valleys and foothills, juniper or pinyon-juniper woodlands, mahogany stands, and the edges of ranches and towns. The population status of the loggerhead shrike is of greatest concern in the eastern United States. The nearest known sighting of loggerhead shrikes occurred at lower elevations on the east side of the Independence Mountains (JBR 1993a). This species was not observed during the 1992 and 1993 field surveys, but suitable habitat exists within the Project area.

White-faced ibis (*Plegadis chihi*) is a Category 2 species that nests in emergent marshes in colonies with herons and egrets. The nearest potential habitat for this species occurs in the Independence Valley and along the North Fork of the Humboldt River (JBR 1993b). No white-faced ibis were observed within the Project area during the field surveys for the mine expansion.

Redband trout *(Oncorhynchus mykiss gibbsi)* is a Category 2 species that occurs in the Owyhee River drainage system on the west side of the Independence Mountains. The nearest documented redband trout population is in Schmitt Creek, which is located about one-half mile south of the Project area (NDOW 1993). Burns Creek has been identified by NDOW as potential habitat for redband trout. At this time it is not known whether these trout are present in Burns Creek or if the closely related rainbow trout (*Oncorhynchus mykiss*) is the species that occupies this drainage. Burns Creek is ephemeral in its upper reaches and perennial at lower elevations. A fishery extends approximately one mile upstream from the Forest boundary. Total fishable length is 0.9 miles, from the elevation of 6,160 feet to 6,480 feet above mean sea level (AMSL).

The spotted frog (*Rana pretiosa*) is a USFWS Category 2 species, also classified as sensitive by the USFS, that is commonly found near permanent water. However, this species may move a considerable distance from water after breeding, often frequenting mixed conifer and subalpine forests, grasslands, and brushlands of sagebrush and rabbitbrush (JBR 1993a). The nearest documented sighting of this species occurred approximately three and one-half miles east of the Project area (JBR 1993a). No evidence of this amphibian was observed during the 1992 and 1993 field surveys of the Project area, although potential habitat for this species exists in the Project area.

Potential habitat for Mattoni's blue butterfly (*Euphilotes rita mattonii*), a USFWS Category 2 species, occurs on ridgetops in the Saval/Steer/Jerritt Canyon area where populations of slenderbrush buckwheat (*Eriogonum microthecum* Nutt. var. *laxiflorum*), the host plant for the larval stage of Mattoni's butterfly, have been documented. No Mattoni's butterflies were observed during the 1992 and 1993 field surveys. Since the Mattoni's

butterfly typically occurs in the upper and lower Sonoran zones and pinyon-juniper woodlands, its presence in the Project area is unlikely.

Sensitive Species

Sensitive species are a USFS classification that pertains to those animals for which population viability is a concern. This is evidenced by: 1) a significant current or predicted downward trend in population numbers or density, or 2) a significant current or predicted downward trend in habitat capability that would reduce the species' existing distribution. The following describes the USFS sensitive species that occur or have the potential to occur within the Project area and that have not been previously discussed under the Candidate species section.

The flammulated owl *(Otus flammeolus)* inhabits forests in northeastern Nevada, possibly including the Independence Mountains (Anderson, pers. comm., 1993). Flammulated owls occur in aspen forests in eastern Nevada, but are more commonly found in ponderosa pine forests in other areas. These owls usually nest in abandoned flicker or other woodpecker nest cavities, from seven to twenty-five feet above the ground. Though no nest sites have been documented, habitat for flammulated owls is likely present within the Project or general study area.

The northern goshawk is a Category 2, USFS sensitive, and USFS management indicator species. Since the MIS status of species is most relevant to this analysis, goshawks are discussed in the next section.

Management Indicator Species

The Humboldt National Forest LRMP and FEIS completed in 1986 identified the northern goshawk, mule deer, sage grouse and trout as management indicator species (MIS). These four species were selected as MIS by the USFS for one or more of the following reasons: 1) they are economically and socially important, 2) they are readily monitored and have high visibility and adequate numbers, 3) they are found in all areas of the Forest, 4) they are somewhat representative of all wildlife species which use a particular vegetative type, 5) they are sensitive to changes in habitat and act as a barometer of the condition and trend of vegetative types, and 6) specific vegetative types provide key habitat for the species during its life cycle (USDA, USFS 1986a-b).

Northern Goshawk

The northern goshawk is listed by the USFWS as a Category 2 species and by the USFS as sensitive, in addition to being an MIS. This species is present within the general study and Project areas. As an MIS, the goshawk is considered a barometer to the condition and trend of old growth cottonwood-aspen and fir stands found in riparian areas on the Forest. If the habitat requirements for the goshawk are met, habitat diversity will be provided for such species as woodpeckers, some other cavity nesting species, and other hawks and owls (USDA, USFS 1986a). Where goshawks occur in Nevada they are typically

found in intermediate woodlands, such as aspen stands, interspersed with sagebrush or meadows. They require large trees, generally hardwoods for nesting that are 30 to 40 feet above the ground. Goshawks eat a variety of prey, particularly small mammals and birds. The CEA province for goshawk is defined as the home range, which is an area within a 1.75 mile radius (6158 acres) of each nest. Several goshawk nests are within the Project area and some goshawk home ranges extend into the Project area.

An intensive study of goshawks is being undertaken at the present time by a graduate student from Boise State University to determine the status and trend of the Independence Mountains' goshawk population. Ten confirmed goshawk nests (nests 025, 026, 027, 031, 037, 039, 134, 135, 136, and 143) occur within the Project area or have home ranges that extend into the Project area. Three historic goshawk nests (nests 074, 127, and 128) are also located within the Project area. Recent information from the goshawk study indicate that these historic nests have not been recently occupied by goshawks (Younk 1993). Nest 074 is considered to be a red-tailed hawk nest, based upon nest location and construction. Nest 127 and 128 are not characteristic of goshawks and are most likely nests of cooper's hawk or other bird species. These three nests are still listed as goshawk nests by NDOW and the USFS and have been evaluated as such for the purposes of this analysis.

The three historic goshawk nests (074, 127, and 128) are located within one nesting territory that is inside the Project area. Portions of the home ranges for these nests have been previously disturbed. Approximately 763 acres (12 percent) have been disturbed within the home range of nest 074. Nests 127 and 128 are about 1,100 feet apart and existing disturbances have affected about 804 acres (13 percent) and 988 acres (16 percent) of the home ranges, respectively.

Goshawk nests 134, 135, and 136 are located inside the Project area in the same nesting territory. These three nests are in close proximity to active mining operations. Nest 134 was occupied in 1991 and nest 136 was used by goshawks in 1992. Previous home range disturbance for nests 134, 135, and 136 is currently about 670 acres (11 percent), 718 acres (12 percent), and 728 acres (12 percent), respectively.

Goshawk nests 026 and 027 are located outside of the Project area, but in the same nesting territory. These two nests are about 4, 400 feet apart and their home ranges extend into the southeastern portion of the Project area. Nest 027 was used by goshawks in 1991 and 1992. This nest is closer to mining disturbance than nest 026. Past home range disturbance for nest 026 is 160 acres (3 percent) and 427 acres (7 percent) for nest 027.

Nests 025, 031, 037, 039, and 143 are located outside of the Project area in separate nesting territories. All five nests were occupied by goshawks in 1991 and 1992. Home ranges for these five nests extend into the Project area. Past home range disturbance to nests 025, 031, and 037 is 87 acres (1 percent), 294 acres (7 percent) and 390 acres (6 percent), respectively. Home range disturbance for nests 039 and 143 is 310 acres (5 percent) and 126 acres (2 percent), respectively.

Mule Deer

Mule deer are present within the general study and Project areas. If the habitat requirements for mule deer are met, habitat diversity will be provided for many other wildlife species. In addition, mule deer are considered to be a barometer for the condition and trend of many of the Forest's non-timbered areas (USDA, USFS 1986a).

The Independence Mountains mule deer herd is in NDOW Area 6, which includes most of the Independence, Bull Run, and the Tuscarora mountain ranges. (See Map 3.7.) The Project area encompasses summer and winter range, as well as fawning habitat. Mule deer transitional range, where deer move between their winter and summer ranges, also exists in the Project area. Transitional range has not been mapped or quantified by the agencies.

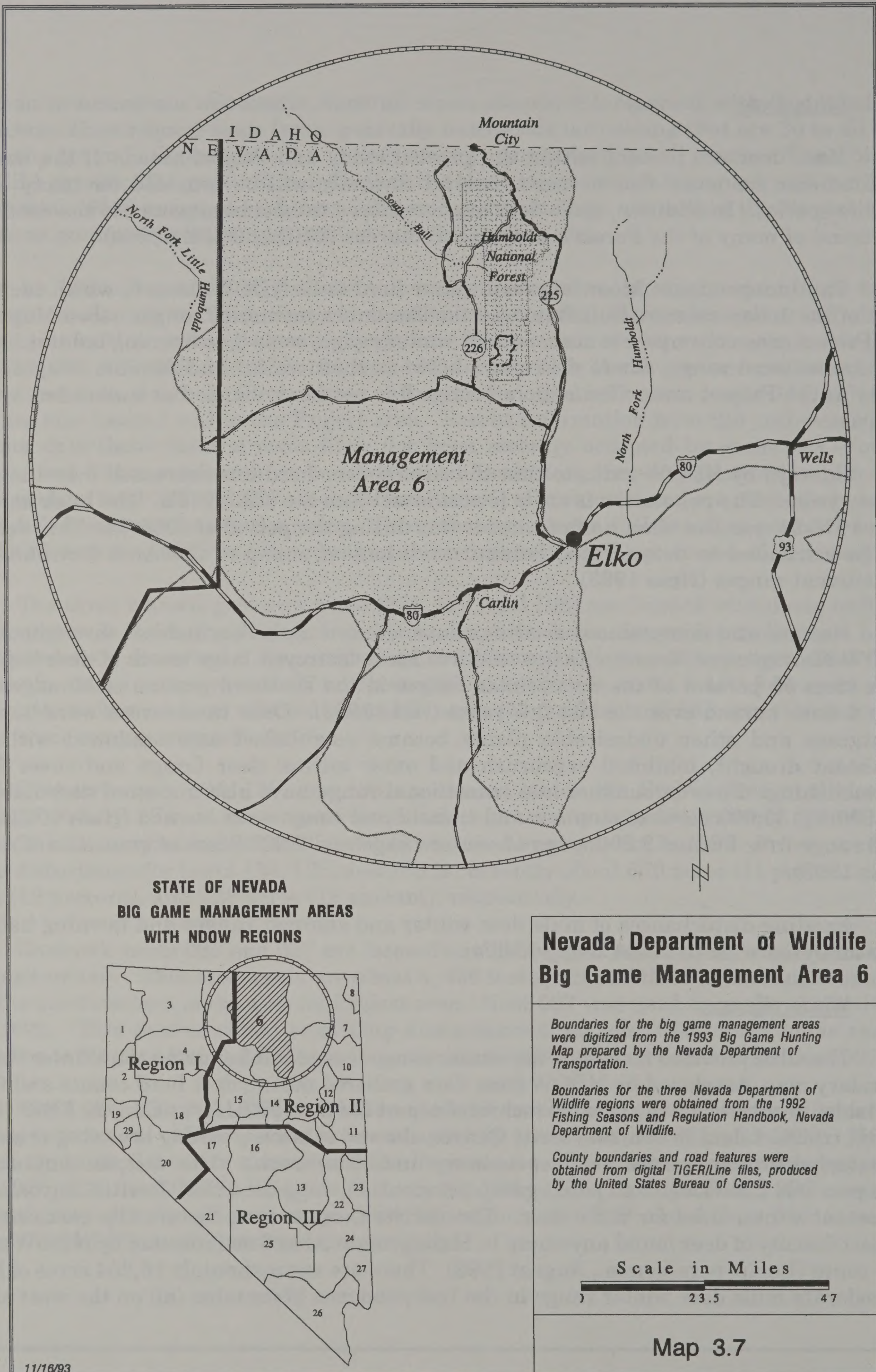
Surveys by NDOW indicate that the Area 6 deer herd has decreased over the past twenty years. The population is at its lowest level since the mid-1970's. The buck harvest from 1973-91 was less than half of what it was during the period of 1956-72. This decline can be attributed to deteriorated habitat conditions on many of the Area 6 winter and transitional ranges (Hess 1993).

Natural and man-induced activities have affected mule deer habitat throughout the NDOW Management Area 6. Range wildfires have destroyed large tracts of deer habitat. More than 65 percent of the deer winter ranges in the southern portion of Management Area 6 have burned over the last few years (Hess 1993). Once these areas were burned, cheatgrass and other undesirable plants became established and combined with the persistent drought, inhibited sagebrush and other critical deer forage and cover from reestablishing. Fires in summer and transitional range have also impacted deer habitat. In 1990-91, 35,000 acres of summer and transitional range were burned (Hess 1992). In 1992 range fires burned 2,300 acres of winter range and 3,000 acres of transitional range (Hess 1993).

Existing disturbances of mule deer winter and summer ranges and fawning habitat were analyzed with the CEA using RVR's.

Winter Range

The CEA province for mule deer winter range was identified using the Winter Range Boundary map, developed by NDOW from data gathered during deer herd counts and from available literature. In the wildlife technical report for the 1980 Jerritt Canyon FEIS (ERT 1979i), transect data in central Jerritt Canyon showed relatively strong browsing pressure of preferred browse species (i.e., serviceberry and bitterbrush). This fact, in conjunction with previous knowledge and pellet group information, suggested that Jerritt Canyon is an important winter area for mule deer. The Jerritt Canyon area historically contains the highest density of deer found anywhere in Management Area 6 as indicated by NDOW's fall deer count (Lamp, pers. comm., August 1993). There are approximately 16,204 acres of high to moderate mule deer winter range in the Independence Mountains (all on the west slope


IDAHO
NEVADA
Mountain City
South Bull
North Fork Little Humboldt
Humboldt National Forest
225
226
North Fork Humboldt
Management Area 6
80
Wells
Elko
93
Carlin
80
STATE OF NEVADA
BIG GAME MANAGEMENT AREAS
WITH NDOW REGIONS
Region I
Region II
Region III
1
2
3
4
5
6
7
8
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
29
Nevada Department of Wildlife
Big Game Management Area 6
Boundaries for the big game management areas were digitized from the 1993 Big Game Hunting Map prepared by the Nevada Department of Transportation.
Boundaries for the three Nevada Department of Wildlife regions were obtained from the 1992 Fishing Seasons and Regulation Handbook, Nevada Department of Wildlife.
County boundaries and road features were obtained from digital TIGER/Line files, produced by the United States Bureau of Census.
Scale in Miles
0
23.5
47
Map 3.7
11/16/93

of the range) within the Humboldt National Forest. Additional key winter ranges in Management Area 6 include the Owyhee Desert, Izzenhood Range, and the Sheep Creek Range.

Wintering mule deer are usually found on the south facing exposures and windswept slopes in the sagebrush/grassland and south facing mountain brush community types located along the lower drainages. Of the 16,204 acres of high and moderate mule deer winter range identified by the CEA model in the Independence Mountains, 1,833 acres (11 percent) of high and moderate value winter range have been or will be affected by the approved mining operations.

Summer Range

Potential mule deer summer range was identified and mapped for the Independence Mountains CEA model utilizing vegetation community type data. Watershed boundaries define the geographic province for potential summer range. Of the 8,106 acres in the Jerritt Canyon watershed, approximately 591 acres (7 percent) are considered to be high to moderate RVR mule deer summer range. In the 4,038 acre Burns Creek watershed, about 44 acres (1 percent) are considered to be high to moderate RVR mule deer summer range. The CEA technical guide does not differentiate between high and moderate RVR mule deer range. Potential deer summer range is characterized by the aspen, sagebrush, and mountain brush community types in association with herbaceous meadow and riparian community types along stream courses. The potential summer range is all high elevation and is commonly found near the summit and the eastern side of the Independence Mountains. Mining activities have resulted in the disturbance of about 55 acres (9 percent) of potential mule deer summer range in the Jerritt Canyon watershed and another three acres (7 percent) in the Burns Creek watershed since 1980.

Fawning Habitat

Potential fawning habitat as identified in CEA occurs principally on slopes with a northern aspect, where stands of serviceberry, chokecherry, currant, snowberry, and Ceanothus provide hiding cover. Aspen stands, especially snowbank aspen, offer additional hiding cover and potential fawning habitat. Watershed boundaries define the geographic province for potential fawning habitat. Approximately 420 acres (5 percent) of the 8,106 acres in the Jerritt Canyon watershed are classified as high to moderate RVR areas for fawning habitat. Of the 4,038 acres in the Burns Creek watershed, about 90 acres (2 percent) are considered high to moderate RVR mule deer fawning habitat. No distinction between high and moderate RVR areas is made in the CEA technical guide. Approximately 44 acres (11 percent) of potential fawning habitat have been disturbed in the Jerritt Canyon watershed and seven acres (8 percent) in the Burns Creek watershed since mining started in 1980.

Sage Grouse

Sage grouse occur primarily in the sagebrush community types in the North Fork and Independence Valleys and at higher elevations in the Independence Mountains. This species is considered to be an indicator of the condition and trend of the sagebrush/grassland, herbaceous meadow, and riparian community types. Other wildlife species such as sage thrasher *(Oreoscoptes montanus)*, Brewer's sparrow *(Spizella breweri)*, and the common crow and raven will be provided for if the habitat requirements are met for sage grouse. Sage grouse are the primary species of upland game bird occurring in and around the Project area.

Potential sage grouse brooding habitat has been identified within the Project area and general study area. The CEA province for potential brooding habitat analysis is third order watersheds within the Independence Mountains. Approximately 3,408 acres (42 percent) of the 8,106 acres within the Jerritt Canyon watershed are considered potential sage grouse brooding habitat. About 1,273 acres (32 percent) of the 4,038 acres in the Burns Creek watershed are considered potential sage grouse brooding habitat. Sage grouse typically remain near streams and meadows during the summer months and in areas with exposed sagebrush on ridge tops at lower elevations during the winter. In spring, males prefer relatively open areas adjacent to dense sagebrush cover for strutting grounds. Sage grouse may move up to 50 miles or more throughout the year. In the winter, sage grouse feed primarily on leaves of big sagebrush, but will also utilize alkali sagebrush and low sagebrush (Back, pers. comm.). In other seasons they will feed on forbs and some insects as well as sagebrush.

Sage grouse populations in Elko County are currently estimated to be at moderate levels and stable (Stiver 1993a). 1993's spring moisture patterns were favorable and temperatures were variable but adequate to provide excellent growth (Stiver 1993a). Storms passing through the region appear to have had an adverse effect on insects, which may have resulted in fewer insects than desirable for sage grouse. Preliminary brood survey data from the region indicates fair to good sage grouse production.

Approximately 262 acres (7 percent) of potential sage grouse brooding habitat have been previously disturbed in the Jerritt Canyon watershed. Another 185 acres (14 percent) of disturbance have occurred to potential brooding habitat in the past within the Burns Creek watershed.

Trout

Trout were selected as an MIS because they provide an indication of water quality and of the condition and trend of riparian zones. Many species of wildlife and fish that are wholly or partially dependent upon riparian areas will be provided for if the habitat requirements for trout are satisfied. Lahontan cutthroat trout and red band trout are the primary species of interest in or near the Project area. These two species were discussed under endangered, threatened, candidate and sensitive species. The threatened Lahontan

cutthroat trout occurs outside of the Project area. Jerritt Creek and its tributaries do not sustain reproducing fish populations within the Project area.

Golden Eagles and Other Raptors

Golden eagles (*Aquila chrysaetos*) are currently nesting along large rock outcrops, cliffs, and trees in and around the Project area. Several golden eagles were observed within the Project area during field surveys conducted for the mine expansion. One nest referred to as the Jerritt tree nest is located within the Project area. A second nest, referred to as the lower Jerritt nest, is located just west of the Project area. Both nests have been occupied in recent years. These nests are outside of the disturbance area of the proposed action and all action alternatives.

Because the federal Bald and Golden Eagle Protection Act requires that any application for a permit to "take" a golden eagle nest must be accompanied by documentation of the present nesting population of eagles within a ten mile radius of the nest proposed for taking, a survey was completed during 1993. Survey results noted seven golden eagle territories within a ten mile radius of the pinnacle nest. The seven territories included a total of twelve golden eagle nests, some of which are utilized as alternate nest sites. Of the seven territories, four were active in 1993, including one within the Project area and one immediately west of the Project area (JBR 1993c).

Previously there had been a third nest within the Project area. IMC received permission from the USFWS on November 12, 1993, to remove an unoccupied golden eagle nest referred to as the pinnacle nest. Removal of the nest was completed on November 23, 1993. This nest was within the disturbance area for the proposed action (JBR 1993c). It had not been active since it was first identified in 1977, three years before mining began in Jerritt Canyon. Seasonal restrictions had been established by the USFS for exploration activities within a 0.25 mile radius around the nest to avoid potential impacts on nesting eagles. Continuance of this restriction had the potential to interfere with drilling operations or future mining.

Other raptors observed in and around the Project area include red-tailed hawk *(Buteo jamaicensis)*, prairie falcon (*Falco mexicanus*), great horned owl (*Bubo virginianus*), northern harrier (*Circus cyaneus*), Swainson's hawk (*Buteo swainsoni*), Cooper's hawk (*Accipiter cooperii*), and turkey vulture (*Cathartes aura*) (ERT 1979i). One prairie falcon, one Cooper's hawk, and numerous turkey vultures were observed during 1992 field work (Coburn 1992). Other raptors known to occur within the Project area include sharp-shinned hawks (*Accipiter striatus*), long-eared owls (*Asio otus*), northern saw-whet owls (*Aegolius acadicus*), and western screech owls (*Otus asio*) (Lamp 1993).

Upland Game Birds

Upland game birds that inhabit the area include blue grouse (*Dendragapus obscurus*), chukar (*Alectoris graeca*), mourning dove (*Zenaida macroura*), and gray partridge (*Perdix perdix*) (ERT 1979).

Blue grouse breed at lower elevations, but move up to stands of conifers or to timberline in autumn. Potential blue grouse habitat represents less than one percent of the total Project area, according to the CEA methodology that uses specific characteristics of the vegetation to define suitable habitat.

Chukar were observed during the 1992 field survey primarily on upper slopes in the community types dominated by big sagebrush with an understory of cheatgrass. Grass and forb seeds are an important food source. In the spring and early summer, insects are an important forage item for growing chicks.

Mourning doves are summer residents that occur in all community types. Nesting takes place primarily in the community types dominated by trees and shrubs.

Gray partridge primarily occupy agricultural lands, especially those under irrigation. They winter at lower elevations on the valley floors. High snow depths reduced populations during the 1992-1993 winter (Stiver 1993b).

Furbearers and Predators

The general study area contains coyote (*Canis latrans*), short-tailed weasel (*Mustela erminea*), long-tailed weasel (*Mustela frenata*), raccoon (*Procyon lotor*), western spotted skunk (*Spigale putorius*), striped skunk (*Mephitis mephitis*), badger (*Taxidea taxus*), bobcat (*Felis rufus*), beaver (*Castor canadensis*) and mountain lion (*Felis concolor*).

Coyotes hunt throughout the entire Project and general study areas. The results of the Saval Ranch Study's howling survey indicate that the coyote is very common in the Independence Mountains (ERT 1979i). Coyote populations are currently estimated to be stable at moderate to high levels (Stiver 1993a). Weather and range conditions have been favorable for prey base populations (rodents and rabbits).

As evidenced by their diggings, badgers were very common throughout all habitats sampled for the 1980 Jerritt Canyon FEIS (ERT 1979). They were most numerous in the community types dominated by sagebrush at lower elevations, especially near grassy areas. Badgers feed heavily on small mammals such as ground squirrels, which they excavate from their burrows.

Available biological information and harvest data from NDOW indicate that Region II bobcat populations are gradually expanding following the low recruitment years of the mid 1980s (Stiver 1993a). However, the number of harvested bobcats decreased in 1992, compared to the 1987-91 average. This decrease was in response to low pelt prices and harsh winter conditions (Stiver 1993a).

Beaver harvests during 1992-93 were below long term averages, with 451 taken in the NDOW Region II area. Currently, beaver populations in the region are believed to be at moderate levels (Stiver 1993a). Beaver are an aquatic species found in the riparian community type near aspen stands and perennial streams or standing water. The CEA

province for beaver habitat is third order watersheds in the Independence Mountains. There are about 409 acres of potential beaver habitat in the Jerritt Canyon watershed and another 500 acres in the Burns Creek watershed. Previous disturbance of potential beaver habitat within these watersheds has been about 16 acres (4 percent) and 98 acres (20 percent), respectively.

Mountain lions (*Felis concolor*) are known to inhabit the Project area. The animals are wide ranging and make use of mountainous habitats, with concentrated activity in areas with mule deer. The area that extends from the southern part of California Mountain to the headwaters of Stump Creek and into upper Burns Basin appears to be prime lion summer habitat. In past years, an estimated two lions inhabited the Independence Mountains in the vicinity of the Project area during the summer, and as many as six inhabited the area during the winter months when mule deer are concentrated (ERT 1979i). Sightings of mountain lions in the general study area have occurred regularly between 1978 and the present (McAdoo, pers. comm.) The Management Area 6 mountain lion population is at moderate to high numbers. However, with major losses of the Area 6 deer herd during the winter of 1992 - 1993, it is expected that the lion population may also decrease over time (Stiver 1993a).

Other Species

As a group, the rabbits and hares constitute a very important food base for the larger mammalian and avian predators. Species occurring in the Jerritt Canyon Project area include Nuttall's cottontail (*Sylvilagus nuttalli*), white-tailed jackrabbit (*Lepus townsendi*), and black-tailed jackrabbit (*L. californicus*). The black-tailed jackrabbit and Nuttall's cottontail are typically the most common (ERT 1979i), although in recent years white-tailed jackrabbit populations have increased (McAdoo, pers. comm.). The black-tailed jackrabbit primarily inhabits the sagebrush community type where its numbers are sometimes very high. Nuttall's cottontail occurs throughout the Project area in all habitats but prefers riparian vegetation. The white-tailed jackrabbit is a game animal in Nevada. It occurs in the higher elevations of the Project area, particularly along the edges of the sagebrush/grassland and low sagebrush/grassland community types. Coyotes, bobcats, golden eagles, and red-tailed hawks prey heavily on these animals. Rabbit populations increased in most of NDOW Region II from the mid 1980's to 1990. The population may have peaked in 1990 and declined in 1991 as evidenced by a decline in harvest. However, it appears the Elko County rabbit population peaked a few years later than the rest of Region II (Stiver 1993a).

Rodent species in the Project area include the least chipmunk (*Eutamias minimus*), Richardson ground squirrel (*Spermophilus richardsoni*), Belding ground squirrel (*S. beldingi*), golden-mantled ground squirrel (*S. lateralis*), Townsend ground squirrel (*S. townsendi*), yellow-bellied marmot (*Marmota flaviventris*), Great basin pocket mouse (*Perognathus parvus*), Ord kangaroo rat (*Dipodomys ordi*), northern pocket gopher (*Thomomys talpoides*), northern grasshopper mouse (*Onychomys leucogaster*), deer mouse (*Peromyscus maniculatus*), bushy-tailed woodrat (*Neotoma cinerea*), mountain vole (*Microtus

montanus), sagebrush vole (*Laguras curtatus*), western jumping mouse (*Zapus princeps*), and porcupine (*Erethizon dorsatum*) (ERT 1979i).

Insectivores in the Project area include Merriam's shrew (*Sorex merriami*), vagrant shrew (*S. vagrans*), and northern water shrews (*S. palustris*). Bats include little brown myotis (*Myotis lucifugus*), hoary bat (*Lasiurus cinerus*), silver haired bat (*Lasionycteris noctivagans*), long-eared myotis (*M. evotis)*, long-legged myotis (*M. volans*), and small-footed myotis (*M. subulatus*), and the big brown bat (*Eptesicus fuscus*). During 1992 mist nest surveys of the two man-made stock ponds located in the north portion of the Project area, 21 bats were captured (12 long-eared myotis and 9 little brown myotis) (JBR 1993a).

Cavity nesting birds require dead trees, stumps, or branches within which they excavate a nest or utilize an existing hole or natural cavity. In the Project area they commonly utilize aspen for their nest trees. Although cavity nesting birds were not identified as a wildlife issue, they can provide an indication of aspen stand condition, which was identified as an issue. The CEA attributes of potential cavity nester habitat are defined as the mature aspen or subalpine fir/pine community types. The province for potential cavity nester habitat is third order watersheds within the Independence Mountains. Of the 8,106 acres in the Jerritt Canyon watershed, approximately 879 acres (11 percent) are classified as potential cavity nester habitat. Within the 4,038 acres in the Burns Creek watershed, about 1,358 acres (34 percent) are considered as potential habitat for cavity nesters. Aspen is the dominant tree species in the area and forms the only forest stands available to cavity nesters. These stands are important to numerous species of cavity nesting birds, as well as canopy nestings species. The existing mining operations have disturbed about 126 (14 percent) acres of potential cavity nester habitat in the Jerritt Canyon watershed and another 190 acres (14 percent) in the Burns Basin watershed. These disturbance acreages are very similar to those for aspen habitat fragmentation, as discussed in the vegetation section.

Although neotropical migrant bird species as a whole did not emerge as an issue during the EIS public scoping process, concern for these species is mounting at the national and international levels primarily because of their dependence upon tropical habitats in Central and South America during the winter. In addition to many of the bird species already mentioned, neotropical migrants include songbirds and most other species present within the Project and general study areas. As indicated by baseline data collected during the Saval Project, neotropical migrants, most of which are considered nongame birds, are very diverse and numerous within the Independence Mountains. The riparian ecosystem, with its vegetative structural diversity including herbaceous, low shrub, mid-shrub (willow), and tree (aspen) communities are inhabited with a particularly diverse array of species specialized for nesting and/or feeding within these layered habitats.

Other habitats such as sagebrush/grass and mountain brush also contain habitat for neotropical migrants. A survey conducted just north of the Project area in 1991 identified over 30 species of birds in mountain brush/sagebrush habitats (USFS 1991).

3.4 Land Use

Land Use Planning and Management

The analysis area for land use planning and management is Elko County, with emphasis on the Project area. The Project area includes only National Forest System land and private lands.

Historical uses and land ownership are primary factors in existing land use in Elko County. Nearly three-fourths of the 17,812 square miles in the county are under federal management. The BLM manages about 62 percent and the USFS administers approximately ten percent of the public lands (USDI, BLM 1989). Both the BLM and the USFS have planning documents that guide the use of the land these agencies manage. Private land use is guided in part by county and city planning documents.

Land uses in the county include agriculture, recreation, mining, towns and associated business centers, residences and infrastructure. Agriculture is the primary land use in Elko County. Over sixty percent of the land in the county is used for ranching and grazing. This includes private ranch lands and federal land used for grazing (USDI, BLM 1989). The federally managed land provides for a variety of other uses including mining, wildlife habitat, and recreation. Approximately 36 percent of the land in the county is used for recreation (USDI, BLM 1989).

Land use in the Project area is managed for multiple use by the USFS and consists of mining, livestock grazing and limited recreational use, primarily hunting. The total Project area comprises 10,849 acres of which 1,272 acres are private inholdings within the Humboldt National Forest (See Map 1.2).

Forest Plan Management Direction - Project Area Management

The Mountain City Ranger District administers the National Forest system lands in the Project area. Management prescriptions for recreation, wildlife and fish, range, timber, water and soil, land exchanges and rights-of-ways, facilities, fire protection, and minerals are included in the Humboldt National Forest LRMP with specific guidance for the Mountain City Ranger District.

The Humboldt National Forest LRMP indicates that 97.2 percent of the Forest is open to mineral entry and 99.9 percent is open to mineral leasing (USDA, USFS 1986b). Lands withdrawn from mineral entry consist primarily of wilderness areas. Of 479,215 acres in the Mountain City District, 477,500 acres are open to mining and leasing (USDA, USFS 1986b). Reserved and outstanding mineral rights on the Humboldt Forest total 30,325 acres or 1.2 percent of the Forest (USDA, USFS 1986b). Under current management direction, the policy of the Forest is to integrate the development of mineral resources with the use and conservation of other Forest resources (USDA, USFS 1986b). For locatable minerals, lands open to entry have not been restricted. In most areas, mitigation measures and

management constraints are added to operating plans for mining activities to provide for environmental protection (USDA, USFS 1986b).

BLM Resource Management Plan

The BLM completed a Resource Management Plan for the Elko Resource Area in 1987. The plan states that the resource area is open to mineral entry for locatable minerals except for an 11-acre administrative site in the City of Elko. The plan's objective for mineral resources is to keep public land open for exploration, development and production while mitigating conflicts with wildlife, wild horses, recreation and wilderness resources (USDI, BLM 1989).

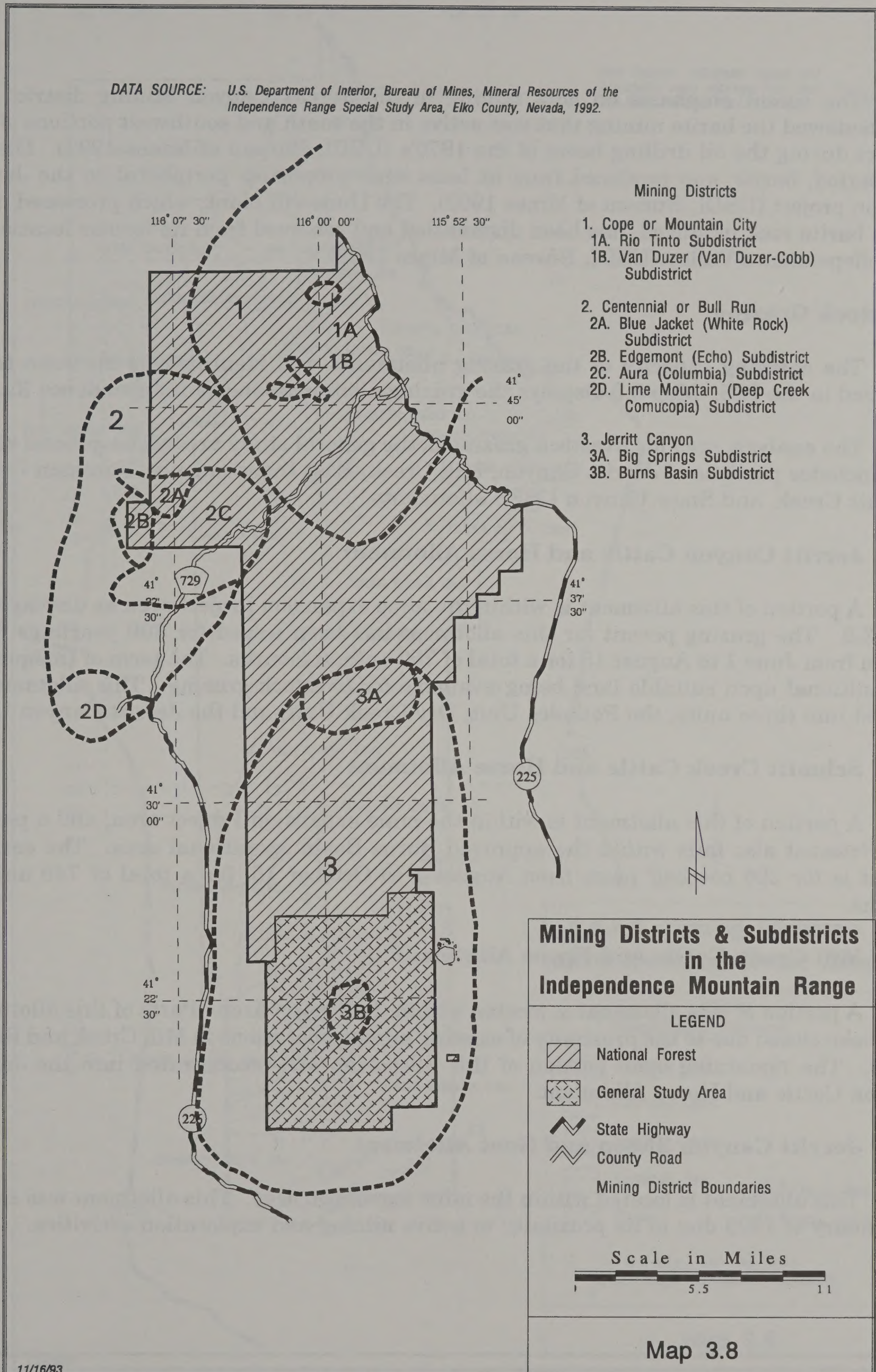
Elko County Land Use Planning

County land use controls include the county zoning ordinance, mobile home regulations, and state subdivision regulations. The Elko County Commissioners recently adopted an interim land use plan, The Elko County Federal Land Use Plan, which establishes county policy regarding federal decisions which may affect local custom, culture, and community stability (Moore, pers. comm.). The interim plan supports the doctrine of multiple use of federal lands for recreational and economic purposes. The county's policy regarding mining states that it is imperative to the well-being of the nation and of Elko County that mining on federal lands should remain open and free to the public. In January 1993, the County Commissioners appointed a seven member Elko County Public Land Use Advisory Committee, which reviews proposals for use of federal lands in the county (Moore, pers. comm.).

Mining

The analysis area for mining is the Jerritt Canyon Mining district, depicted on Map 3.8. The Jerritt Canyon mining district is the largest district identified by the U.S. Bureau of Mines in the Independence Mountains. Known mineral resources within the Jerritt Canyon district include gold, silver, barite, sulfur-bearing shale, and antimony. The Jerritt Canyon Mining District includes the National Forest lands south of Jack Creek, as well as privately owned and BLM lands to the east, west, and south of the Forest boundary (USDI, Bureau of Mines 1992). Unlike many other Nevada mining districts, it has virtually no historical lode or placer mining activity for gold. The earliest records are of 1918 discoveries by sheepherders of antimony in Jerritt Canyon and in Burns Basin. Gold production has been recorded since 1981.

The majority of current mining and exploration activity in the Jerritt Canyon Mining district is centered on gold recovery. According to the US Bureau of Mines the Jerritt Canyon mining district has accounted for 96 percent of the total of gold production recorded for the Independence Mountain Range. The Jerritt Canyon mine operations produced 20 million tons of ore and 3.5 million ounces of gold by the end of 1992.


DATA SOURCE: U.S. Department of Interior, Bureau of Mines, Mineral Resources of the Independence Range Special Study Area, Elko County, Nevada, 1992.
Mining Districts
1. Cope or Mountain City
1A. Rio Tinto Subdistrict
1B. Van Duzer (Van Duzer-Cobb) Subdistrict
2. Centennial or Bull Run
2A. Blue Jacket (White Rock) Subdistrict
2B. Edgemont (Echo) Subdistrict
2C. Aura (Columbia) Subdistrict
2D. Lime Mountain (Deep Creek Comucopia) Subdistrict
3. Jerritt Canyon
3A. Big Springs Subdistrict
3B. Burns Basin Subdistrict
116° 07' 30"
116° 00' 00"
115° 52' 30"
41° 45' 00"
41° 37' 30"
41° 30' 00"
41° 22' 30"
1
1A
1B
2
2A
2B
2C
2D
3
3A
3B
729
225
Mining Districts & Subdistricts in the Independence Mountain Range
LEGEND
National Forest
General Study Area
State Highway
County Road
Mining District Boundaries
Scale in Miles
5.5
11
Map 3.8
11/16/93

The recent emphasis on gold mining in the Jerritt Canyon Mining district has overshadowed the barite mining that was active in the south and southwest portions of the district during the oil drilling boom of the 1970's (USDI, Bureau of Mines 1992). During this period, barite was produced from at least nine properties peripheral to the Jerritt Canyon project (USDI, Bureau of Mines 1992). The Hunewill plant, which processed most of the barite rock produced, has been dismantled and removed from its former location in the Independence Valley (USDI, Bureau of Mines 1992).

Livestock Grazing

The carrying capacity of the grazing allotments was identified as an issue to be analyzed in the EIS. Map 3.9 displays the grazing allotments in the Independence Range.

The analysis area for livestock grazing is the general study area. The general study area includes portions of Jerritt Canyon, Mill Creek, East Independence, Foreman Creek, Schmitt Creek, and Snow Canyon USFS allotments.

Jerritt Canyon Cattle and Horse Allotment

A portion of this allotment is within the mine expansion Project area as displayed in Map 3.9. The grazing permit for this allotment has been issued for 300 yearlings for a season from June 1 to August 15 for a total of 750 animal months. The term of this permit is conditional upon suitable land being available for livestock grazing. This allotment is divided into three units, the Potholes Unit, Dry Creek Unit, and the Jerritt Canyon Unit.

Schmitt Creek Cattle and Horse Allotment

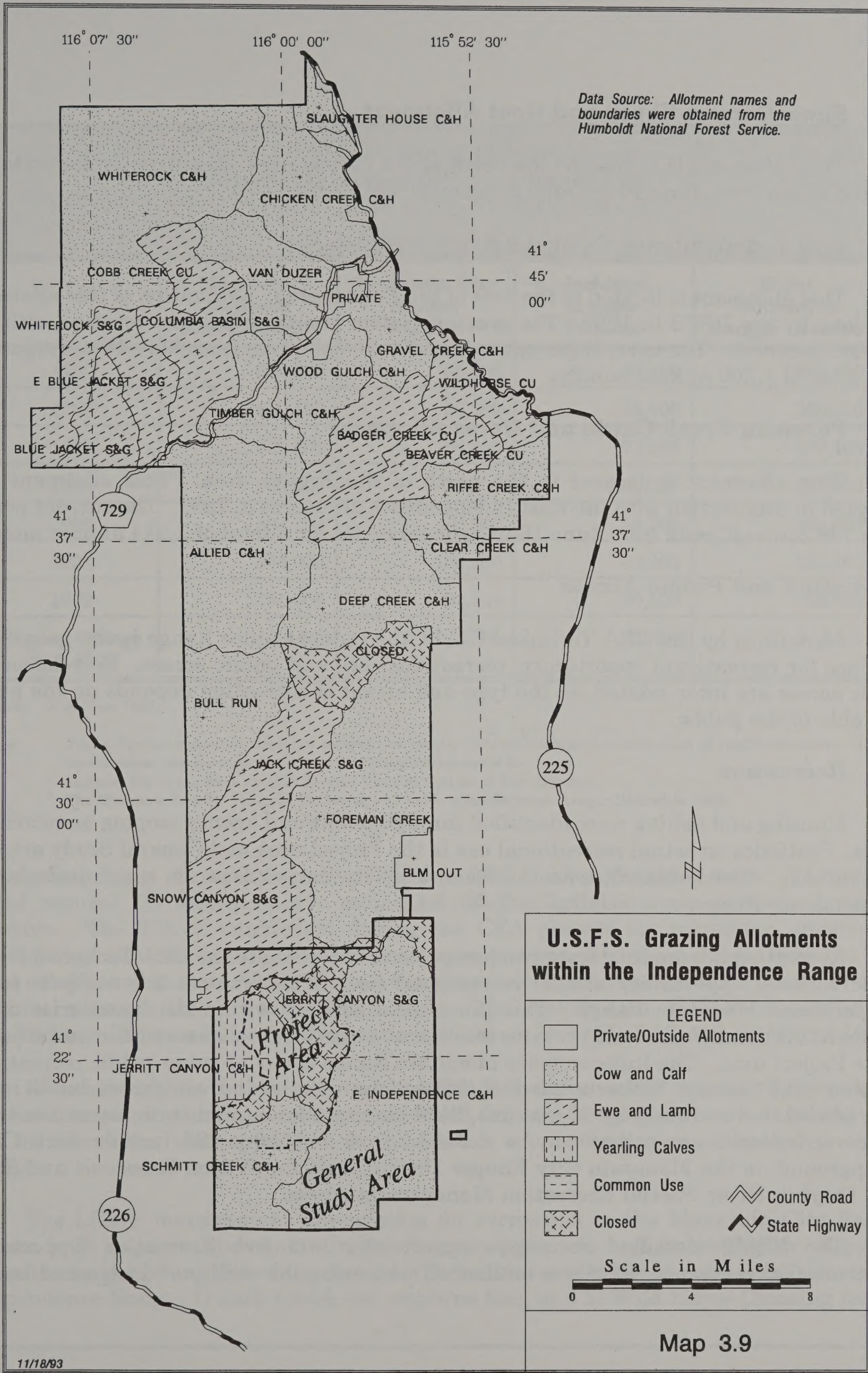
A portion of this allotment is within the mine expansion Project area, and a part of the allotment also falls within the approved Burns Basin operational area. The current permit is for 296 cow/calf pairs from August 1 to October 15, for a total of 740 animal months.

Mill Creek Cattle and Horse Allotment

A portion of this allotment is located within the Project area. Parts of this allotment have been closed due to the proximity of existing mining operations in Mill Creek and Burns Basin. The remaining open portion of this allotment was incorporated into the Jerritt Canyon Cattle and Horse Allotment.

Jerritt Canyon Sheep and Goat Allotment

This allotment is located within the mine expansion area. This allotment was closed in January of 1993 due to its proximity to active mining and exploration activities.


116° 07′ 30″
116° 00′ 00″
115° 52′ 30″
Data Source: Allotment names and boundaries were obtained from the Humboldt National Forest Service.
SLAUGHTER HOUSE C&H
WHITEROCK C&H
CHICKEN CREEK C&H
41° 45′ 00″
COBB CREEK CU
VAN DUZER
PRIVATE
WHITEROCK S&G
COLUMBIA BASIN S&G
GRAVEL CREEK C&H
WOOD GULCH C&H
E BLUE JACKET S&G
WILDHORSE CU
TIMBER GULCH C&H
BADGER CREEK CU
BLUE JACKET S&G
BEAVER CREEK CU
RIFFE CREEK C&H
729
41° 37′ 30″
41° 37′ 30″
ALLIED C&H
CLEAR CREEK C&H
DEEP CREEK C&H
CLOSED
BULL RUN
JACK CREEK S&G
225
41° 30′ 00″
FOREMAN CREEK
BLM OUT
SNOW CANYON S&G
JERRITT CANYON S&G
Project Area
41° 22′ 30″
JERRITT CANYON C&H
E INDEPENDENCE C&H
SCHMITT CREEK C&H
General Study Area
226
U.S.F.S. Grazing Allotments within the Independence Range
LEGEND
Private/Outside Allotments
Cow and Calf
Ewe and Lamb
Yearling Calves
Common Use
Closed
County Road
State Highway
Scale in Miles
0
4
8
Map 3.9
11/18/93

Snow Canyon Sheep and Goat Allotment

This allotment is located to the north of the Project area. It currently supports one band of sheep from June 10 through September 30.

East Independence Cattle and Horse Allotment

This allotment is located to the east of the Project area. Evaluation of this allotment was done by the USFS in 1992. The grazing system is a modified rest rotation with two riparian pastures. The current permit is for 400 cow/calf pairs from May 15 to August 15 for a total of 1,200 animal months.

Foreman Creek Cattle and Horse Allotment

This allotment is located to the north of the Project area. This allotment was analyzed in conjunction with the East Independence allotment in 1992. The current permit is for 748 cow/calf pairs from June 16 to September 15, for a total of 2,244 animal months.

Recreation and Public Access

As defined by the CEA Technical Guide, the Independence Range is the geographic province for recreational opportunity, recreational use and public access. Recreation and public access are inter-related, as the type and extent of recreation depends on the access available to the public.

Recreation

Hunting and fishing were identified through public and agency scoping as recreation issues. Statistics on actual recreational use in the Project area and General Study area are not available. Visitor statistics for the Mountain City Ranger District, which includes the Independence Range, are included in Table 3.11.

Recreation is examined from two perspectives according to the CEA Technical Guide: 1) recreational opportunity and 2) recreational use. The province for analysis is the Independence Mountain Range. This province is entirely within the boundaries of the Humboldt National Forest and provides focus for site-specific conditions within and adjacent to the Project area. The Independence Mountain Range is one of many public recreational areas in Elko County. Other areas include National Forest and wilderness lands in the Ruby Mountains and Jarbidge Mountains, BLM managed lands, and state recreation areas. Some recreational areas that can be accessed from Highway 226 include Jack Creek Campground on the Mountain City Ranger District, and the Wilson Reservoir and South Fork Owyhee River Special Recreation Management Areas.

The LRMP classified recreation opportunity into five Recreation Opportunity Spectrum (ROS) classes. ROS is a method of measuring the ability of designated land to

Table 3.11
Humboldt National Forest Recreation Visitor Days of Use[1] - 1986-1992 Elko County

	Humboldt National Forest (total)[2]	Mountain City Ranger District	Jarbidge Ranger District	Ruby Mountains Ranger District
1986	606,200	85,000	63,900	225,900
1987	610,100	86,200	63,600	269,600
1988	686,200	106,900	71,300	299,100
1989	803,600	93,200	198,700[3]	317,500
1990	898,200	90,000	53,700	439,600
1991	864,900	100,400	44,300	383,100
1992	755,000	94,100	30,100	330,000
Percent Change 1986-1992	+24.5%	+10.7%	-52.9%	+46.1%

Source: Schaffran 1993.

Note: [1] Forest Service recreation data are collected on ranger districts through a combination of traffic couunters, visual observations, campground receipts and hunting/fishing statistics.
[2] Includes the Santa Rosa and Ely Ranger Districts outside of Elko County.
[3] The "Rainbow Family" National Gathering was held on the Jarbidge Ranger District in 1989.

meet various types of recreation uses. The five ROS classes identified were: (1) rural, (2) roaded natural, (3) semi-primitive motorized, (4) semi-primitive non-motorized, and (5) primitive. The TOC's established during the CEA process for recreation opportunity included any reduction in primitive and semi-primitive non-motorized classes from the 1986 status established in the LRMP. There are no areas designated as rural, primitive or semi-primitive nonmotorized in the Project area. The distribution of ROS classes in the Independence Range and in the Project area is shown in Table 3.12 and on Map 3.10.

Recreational use in the Independence Range includes use of developed recreational sites (such as picnic areas and campgrounds) and dispersed recreation, such as hiking. The TOC for recreation use established in the CEA is where demand is estimated to exceed supply.

The LRMP management prescription for recreation in the Mountain City Ranger District is to improve and maintain existing campgrounds and to emphasize dispersed recreation on the remainder of the district. There are two developed recreation sites in the Independence Range: 1) Jack Creek (no water/no fee), and 2) Wild Horse Crossing fee

Table 3.12 Recreational Opportunity Spectrum Classes in Independence Range and Project Area	Independence Range (Acres)	Project Area (Acres)
Rural	0	0
Roaded Natural	49,325	10,841
Semi-Primitive Motorized	167,193	8
Semi-Primitive Nonmotorized	16,412	0
Primitive	0	0
TOTAL	**232,930**	**10,849**

Source: USFS GIS database, April 7, 1993.

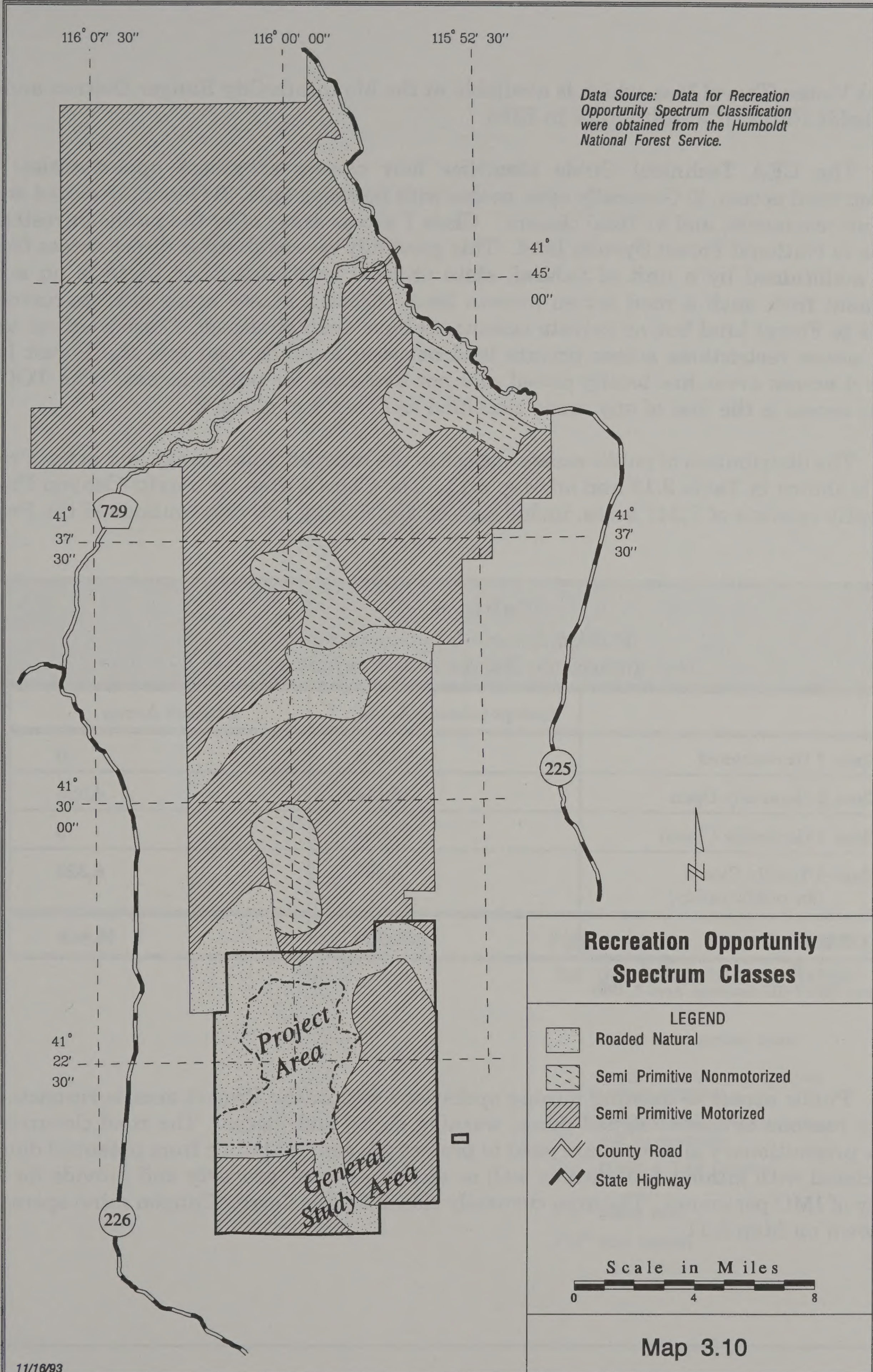
campground. There are no developed recreation sites in the Project area. Dispersed recreational opportunities include hiking, rockhounding, backpacking, picnicking, camping, pleasure driving, hunting, cross-country skiing, and snowshoeing (USDA, USFS 1986a). Recreational use in the Mountain City Ranger District has increased by approximately 11 percent over the last six years. Recreational use in the Ruby Mountains Ranger District, closer to the city of Elko, increased by 46 percent. The supply of dispersed recreation opportunities currently exceeds demand in the Independence Range according to the LRMP and USFS personnel (Schaffran, pers. comm.).

Although historical documentation of recreational use in the Project and general study area is unavailable, USFS personnel indicate the predominant recreational activity within the Project area is hunting. Hunting occurs primarily in the fall for mule deer and sage grouse.

There are no roadless or wilderness areas within or adjacent to the Project area. The CEA province for roadless areas is the identified roadless areas in the Independence Range. These areas are identified on Map 3.10 as semi-primitive nonmotorized areas. The 27,905 acre Independence Roadless Area Number 389 lies to the north of the Project area. There are no wilderness areas in the Independence Range Province. The closest wilderness area is the Jarbidge Wilderness area, approximately 30 miles from the Project area.

Public Access

The analysis area for public access is the Independence Range. The detailed analysis area is the proposed Project area. Gates and points of restriction are indicated on the 1990


116° 07′ 30″
116° 00′ 00″
115° 52′ 30″
Data Source: Data for Recreation Opportunity Spectrum Classification were obtained from the Humboldt National Forest Service.
41° 45′ 00″
41° 37′ 30″
41° 30′ 00″
41° 22′ 30″
729
225
226
Project Area
General Study Area
Recreation Opportunity Spectrum Classes
LEGEND
Roaded Natural
Semi Primitive Nonmotorized
Semi Primitive Motorized
County Road
State Highway
Scale in Miles
0
4
8
Map 3.10
11/16/93

Forest Visitor/Travel Map which is available at the Mountain City Ranger District and the Humboldt National Forest Office in Elko.

The CEA Technical Guide identifies four classes of access opportunities: 1) Unrestricted access, 2) Generally open access with no easements, 3) Generally closed access with no easements, and 4) Total closure. Class 1 access areas offer the public unrestricted access to National Forest System land. This generally means there is direct access from a road maintained by a unit of federal, state or local government, or there is an access easement from such a road across private land. Class 2 access areas offer unrestricted access to Forest land but no private easements have been obtained. Class 3 access areas have access restrictions across private land between a public road and the Forest land. Class 4 access areas are totally closed and not available for public access. The TOC for public access is the loss of any areas classified as Class 1 or Class 2.

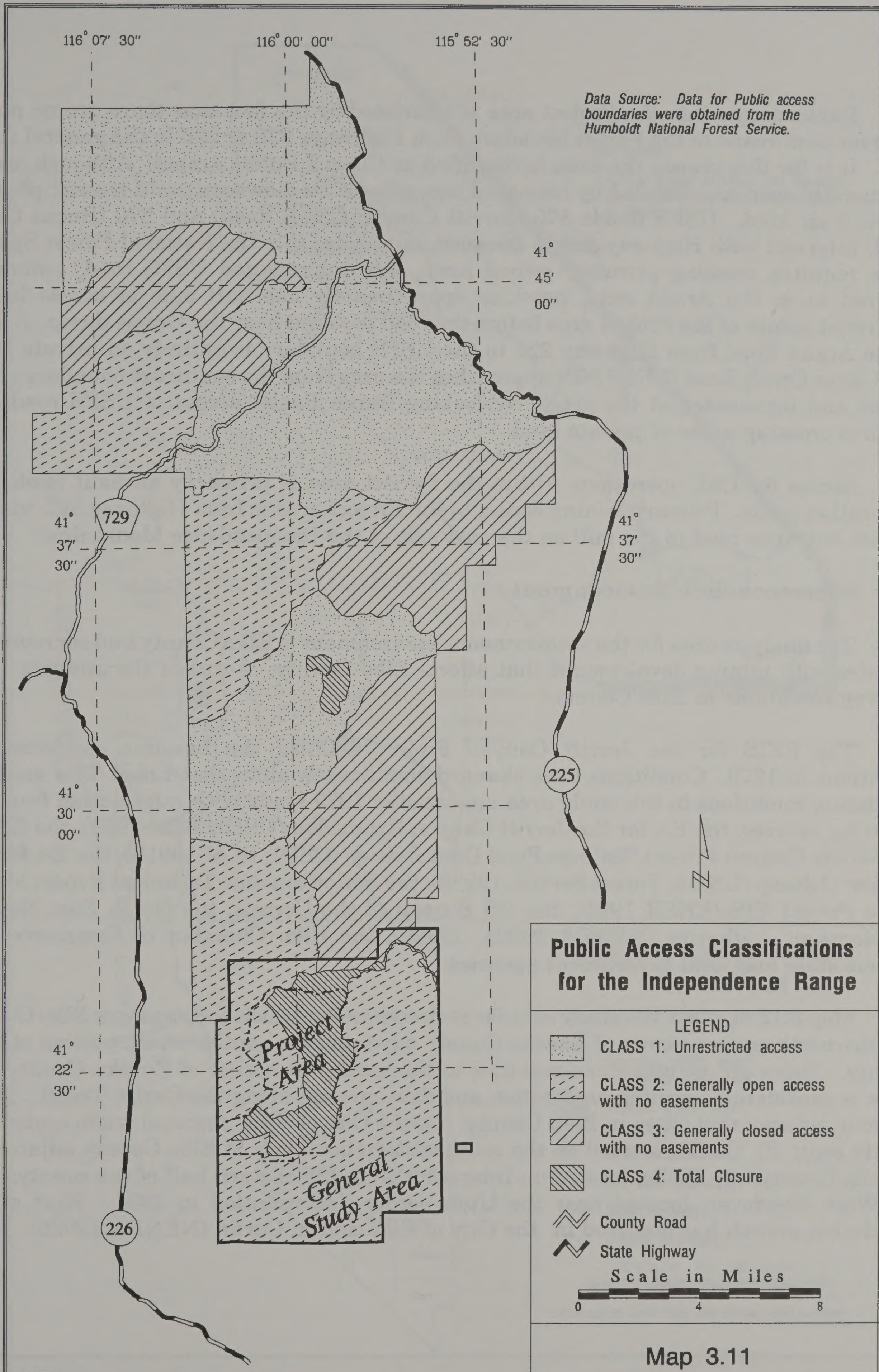
The distribution of public access classes in the Independence Range and in the Project area is shown in Table 3.13 and on Map 3.11. The Class 4 area for Jerritt Canyon Project currently consists of 7,347 acres, including existing mining activities outside of the Project area.

Table 3.13
Public Access Classes in the Independence Range and Project Area

	Independence Acres	Project Acres
Class 1 Unrestricted	90,929	0
Class 2 Generally Open	78,154	4,526
Class 3 Generally Closed	55,384	0
Class 4 Totally Closed (for public safety)	8,463	6,323
TOTAL	**232,930**	**10,849**

Source: USFS GIS database, April 7, 1993.

Public access to existing mining operations within the Project area is restricted for safety reasons by use of signed gates, warning signs, and fences. The road closures and other precautionary measures are used to protect the general public from potential dangers associated with mining activities as well as to protect mine property and provide for the safety of IMC personnel. The area currently closed for the Jerritt Canyon mine operations is shown on Map 3.11.



116° 07′ 30″
116° 00′ 00″
115° 52′ 30″
Data Source: Data for Public access boundaries were obtained from the Humboldt National Forest Service.
41° 45′ 00″
41° 37′ 30″
41° 30′ 00″
41° 22′ 30″
729
225
226
Project Area
General Study Area
Public Access Classifications for the Independence Range
LEGEND
CLASS 1: Unrestricted access
CLASS 2: Generally open access with no easements
CLASS 3: Generally closed access with no easements
CLASS 4: Total Closure
County Road
State Highway
Scale in Miles
0
4
8
Map 3.11
11/17/93

Public access into the Project area is restricted by the fact that there are no public easements on roads to the Forest boundary from Highways 225 or 226 in the general study area. It is for this reason the area is classified as Class 2 Public Access. Although access is generally open as indicated by historical use, private land-owners could restrict passage across their land. USFS Roads 875 (Jerritt Canyon Creek Road) and 870 (Burns Creek Road) intersect with Highway 226 to the west, but access into the National Forest System lands requires crossing privately owned land. An unnumbered USFS road, commonly referred to as the Arana road, provides approximately one half mile of access in the northwest corner of the Project area before the road is closed near the Gracie dump. Access to the Arana Road from Highway 226 to the USFS boundary is entirely on private land. The Gance Creek Road (USFS 868) approaches the area from the southeast boundary of the Forest and terminates at the ridge overlooking Burns Basin, access to USFS road also requires crossing areas of private land.

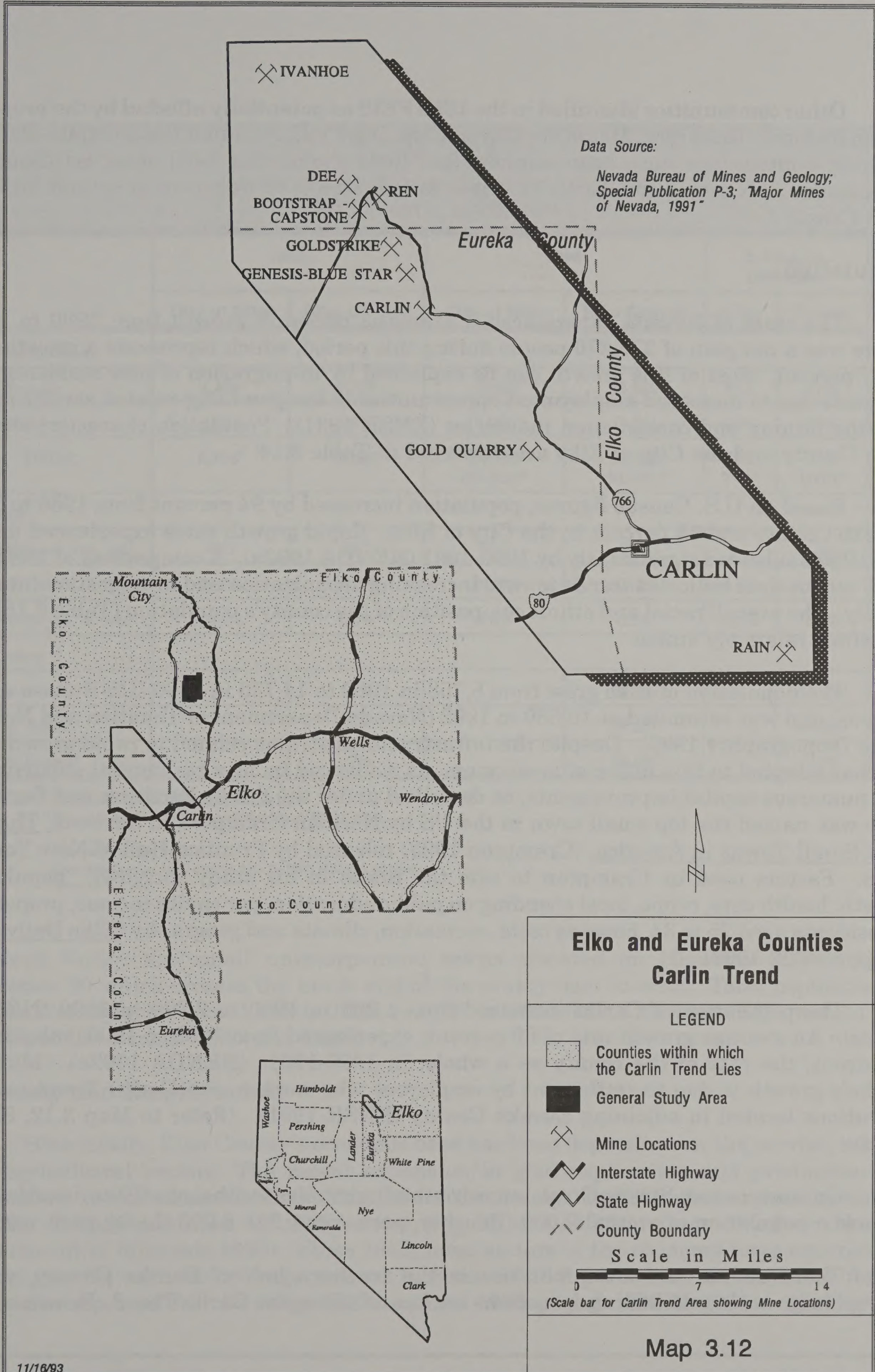
Access for IMC operations within the Project area is primarily on haul roads and exploration roads. Primary mining access to the Project area is from Highway 225, via the private entrance road to the mill on the east side of the Independence Mountains.

3.5 Socioeconomic Environment

The analysis area for the socioeconomic environment is Elko County and surrounding counties with mining development that affects Elko County. Focus of the analysis is on existing conditions in Elko County.

The FEIS for the Jerritt Canyon Project detailed the baseline socioeconomic conditions in 1979. Conditions have changed significantly since that time. This analysis of existing conditions in the study area updates the 1979 study with information from the following sources: the EA for the Jerritt Canyon Expansion (USDI, BLM 1989), the EA for the Jerritt Canyon Project Tailings Pond Dam Raises (USDI, BLM 1991b), the EA for the Alchem C dump (USDA, Forest Service 1992b), the SocioEconomic Technical Report for the Betze Project EIS (ENSR 1991), the US Bureau of the Census, the North East Nevada Development Authority (NENDA 1992a, 1992b), the Elko Chamber of Commerce and various state and local government agencies.

Map 3.12 displays the study area for socioeconomics, which encompasses Elko County and the northeastern corner of Eureka County adjoining the southwestern portion of Elko County. There are no major communities in the northwest corner of Eureka County, but there is considerable mining exploration and development along the Carlin Trend. There are four incorporated cities in Elko County: 1) the City of Elko, regional trade center and county seat; 2) Carlin, located on the southwestern boundary of Elko County adjacent to Eureka County; 3) Wells, located on Interstate 80 in the eastern half of the county; and 4) West Wendover, located near the Utah border, incorporated in 1991. Most of the population growth has occurred in the City of Elko and in Carlin (NENDA 1992b).



IVANHOE
DEE
REN
BOOTSTRAP - CAPSTONE
GOLDSTRIKE
GENESIS-BLUE STAR
CARLIN
GOLD QUARRY
RAIN
Eureka County
Elko County
766
80
CARLIN
Data Source:
Nevada Bureau of Mines and Geology; Special Publication P-3; "Major Mines of Nevada, 1991"
Mountain City
Elko County
Wells
Elko
Carlin
Wendover
Eureka County
Eureka
Humboldt
Washoe
Pershing
Elko
Lander
Eureka
Churchill
White Pine
Lyon
Mineral
Nye
Esmeralda
Lincoln
Clark
Elko and Eureka Counties
Carlin Trend
LEGEND
Counties within which the Carlin Trend Lies
General Study Area
Mine Locations
Interstate Highway
State Highway
County Boundary
Scale in Miles
0
7
14
(Scale bar for Carlin Trend Area showing Mine Locations)
Map 3.12
11/16/93

Other communities identified in the 1980 FEIS as potentially affected by the proposed action included Tuscarora, Mountain City and the Duck Valley Indian Reservation. Impacts to these communities have been minimal and little change has been observed (Boucher, pers. comm.). Existing conditions for these are summarized under other communities in Elko County.

Population

The state of Nevada experienced a dramatic period of growth from 1980 to 1990. There was a net gain of 376,270 people during this period, which represents a growth rate of 47 percent. Most of this growth can be explained by in-migration of new residents into the state due to increased employment opportunities in the gambling-related service sector and the mining and construction industries (ENSR 1991). Population characteristics for Elko County and the City of Elko are displayed in Table 3.14.

Based on U.S. Census figures, population increased by 94 percent from 1980 to 1990 in Elko County and 68 percent in the City of Elko. Rapid growth rates experienced in the late 1980's subsided significantly by 1990-1991 (NENDA 1992a). A comparison of 1980 and 1990 census data indicates trends toward increasing urbanization and in-migration into the county. The overall racial and ethnic composition of the county's population (Table 3.15) has remained relatively stable.

The population of Elko grew from 8,758 in 1980 to 14,736 in 1990 (US Bureau of the Census) and was estimated at 16,580 in 1992 (Nevada Department of Taxation and Nevada State Demographer 1992). Despite the infrastructural strains related to rapid growth, the city has adapted to this influx of newcomers, as evidenced by new residential subdivisions and numerous capital improvements, as described under the Public Facilities and Services. Elko was named the top small town in the US by Norman Crampton in his book, The 100 Best Small Towns in America, (Crampton 1993) released by Prentice Hall of New York in 1993. Factors used by Crampton to rate the towns in his study included: population growth, health care, crime, local spending on public education, per capita income, proportion of residents aged 25 to 34, housing costs, recreation, climate and geography (Elko Daily Free Press, Feb. 2, 1993).

The population of Carlin increased from 1,232 in 1980 to 2,270 in 1990 (NENDA 1992a). An average growth rate of 69 percent, experienced from 1985 to 1990, subsided to 4 percent, the rate of the county as a whole, in 1990-1991 (NENDA 1992a). Much of Carlin's growth is due to settlement by employees who work in the Carlin Trend mining operations located in adjoining Eureka County (ENSR 1991). (Refer to Map 3.12, Study Area).

Unincorporated Spring Creek, approximately six miles southeast of Elko, is estimated to have a population of around 7,000 (Boucher, pers. comm.) to 8,000 (Ladd, pers. comm.).

There are no major communities in the northern half of Eureka County, where several large-scale gold mining operations are located along the Carlin Trend. Beowawe and

Table 3.14
Selected Population Characteristics
Elko County, 1980-1990

	1980		1990		% Change 1980-1990	
	City of Elko	Elko County	City of Elko	Elko County	City	County
Population[1]						
Female	4,354	8,198	7,030	15,689	61%	91%
Male	4,404	9,071	7,706	17,841	75%	97%
TOTAL	8,758[3]	17,269	14,736 (15,520)[2]	33,530 (34,570)[2]	68% 77%[4]	94% 100%[4]
Age						
Median Age, yrs.	30.7	29.7	30.0	29.4		
% Under 18 yrs.	29.9%	31.2%	30.6%	32.2%	0.7%	1%
% 65 yrs. & over	10.5%	5.0%	7.8%	6.1%	-3.7%	1.1%
Other						
% Urban		51%		61.8%		10.8%
% Rural		49%		38.2%		-10.8%
% Native[5]		37%		29.6%		-7.4%

Sources: [1] US Bureau of the Census, 1980 and 1990.
[2] Business Portrait of Northeast Nevada, NENDA 1992.

Notes: [3] Contested as low by city.
[4] Calculated using 1980 census data & 1990 NENDA estimates.
[5] Born in Nevada.

Crescent Valley are small unincorporated towns situated on Highway 306 south of Interstate 80 which crosses the north end of the county east to west. Total population in Eureka County grew from 1,198 in 1980 to 1,547 in 1990 for an increase of 29 percent (US Bureau of the Census 1980 and 1990).

Economy and Employment

Historically, Elko County's economic base has been dependent on the service, mining and agricultural sectors. The recent expansion in gold exploration and production has resulted in overall economic diversification for the county. In 1992, three mines operating in Elko County produced 427,205 ounces of gold and 44,364 ounces of silver (Nevada Department of Minerals 1993). Since 1985, most sectors of the economy have experienced strong growth, with an average annual increase of 13.9 percent in employment for all industries reported for the June 1987 to June 1989 period (ENSR 1991). Mining and

Table 3.15
Population Distribution by Race
Elko County, 1980-1990

Racial Group[1]	1980				1990			
	City of Elko		Elko County		City of Elko		Elko County	
		% Total Pop.		% Total Pop.		% Total Pop.		% Total Pop.
White	7,704	88%	14,747	85%	13,146	89%	28,970	86%
Black	41	0.5%	81	0.5%	63	0.4%	266	0.8%
American Indian, Eskimo, Aleut	442	5%	1,468	8.5%	404	3%	2,128	6%
Asian, Pacific Islander	64	0.7%	106	0.6%	173	1%	277	0.8%
Other	507	5.8%	867	5%	950	6%	1,889	6%
TOTAL[2]	**8,758**	**100%**	**17,269**	**99.6%**	**14,763**	**99.4%**	**33,530**	**99.6%**

Source: [1] US Bureau of the Census, 1980 and 1990. The U.S. Bureau of the Census includes persons of Hispanic origin under the various racial groups listed. Census records indicate there were 1,046 and 1,842 persons of Hispanic origin in 1980 in the City of Elko and Elko County, respectively. In 1990, there were 2,215 and 4,339 in the City of Elko and Elko County.

[2] Some total percentages may be less than 100% due to rounding errors.

construction have become major contributors to the Elko County economy in the last few years. The largest growth in employment has been in the construction, trade and mining sectors (ENSR 1991). The total percent change in employment by industry for the period 1977 to 1990 is indicated in Table 3.16. Employment trends by industry are displayed in Figure 3.2.

Table 3.15 indicates a 1990 census figure of 4,473 for mining industry employment in Elko County, which includes workers employed by mining operations located in Eureka County, but who reside in Elko County. In 1991, nine percent of the labor force in Elko County were employed by the mining industry. In Eureka County, 87 percent were employed by the mining industry in 1991 (Anastassatos, pers. comm., March 1993). Figure 3.3 displays percentages of mining employment in Elko and Eureka Counties.

IMC has provided sizeable employment and economic benefits for Elko County over the past ten years, averaging over 600 jobs a year from 1991 to 1993. The annual payroll is $23.2 million based on an average 1993 wage of $38,700. The University of Nevada-Reno conducted a study which revealed that every job and payroll dollar generated by the mining industry creates 1.0 to 1.25 additional jobs in supporting businesses (USFS 1992b). When applied to the 600 jobs, this "multiplier" yields approximately 750 additional jobs and $16 million per year in wages within the support sector. In addition, IMC has contributed to

Table 3.16
Employment Distribution by Industry
Elko County, 1977-1990

Industry	1977[1]	1980[2]	1987[3]	1990[4]	Total % Change 1977-1990
Agriculture, forestry, fisheries	730	1,386	950	762	4%
Mining[6]	240		950	4,473 1,290[5]	1,746% 437%[7]
Construction	320	635	830	1,111	247%
Manufacturing	50	233	130	312	524%
TCPU[8]	640	782	640	917	43%
Trade	1,350	1,396	2,020	2,616	94%
FIRE[9]	190	339	250	406	114%
Service	2,050	3,006	4,810	5,291	158%
Government	1,364	959	1,840	2,404	76%

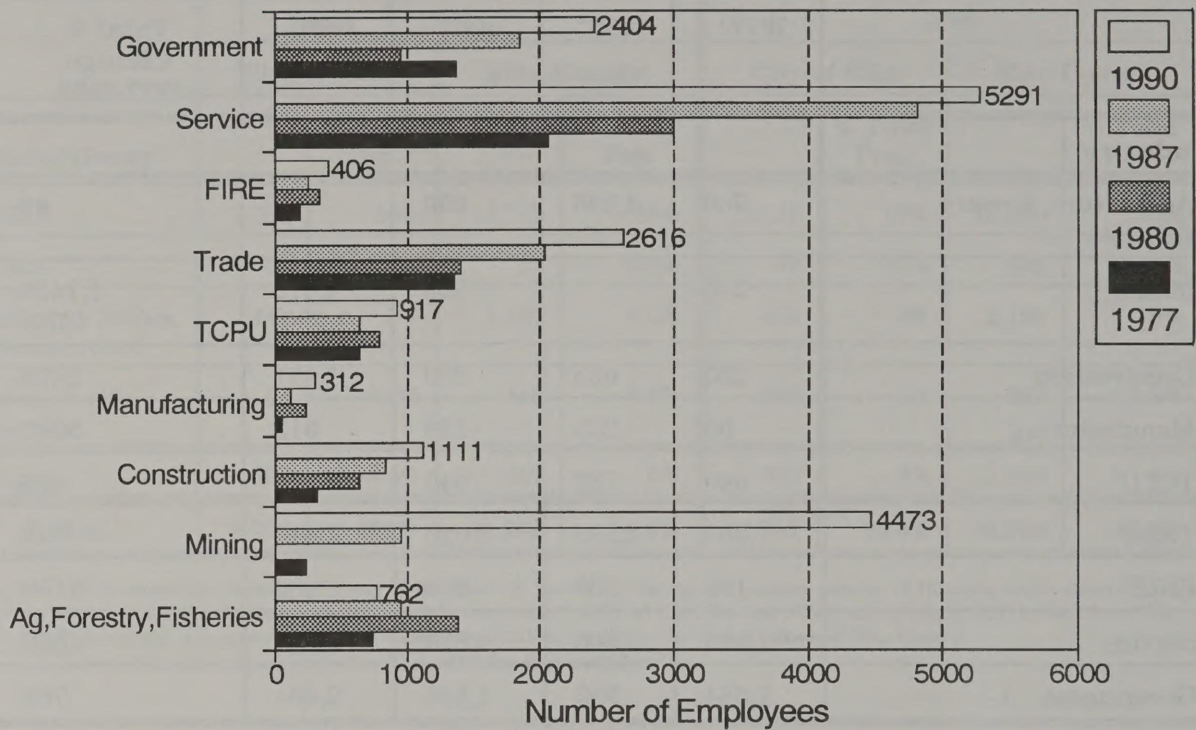
Sources:
1 Socioeconomic Component, Technical Report, Jerritt Canyon EIS, 1979.
2 US Bureau of the Census, Census of Population & Housing, 1980.
3 Socioeconomic Technical Report, Betze Project EIS, ENSR, 1991.
4 US Bureau of the Census, Census of Population & Housing, 1990.
5 Anastassatos, Geo., Dept. of Employment Security. This figure includes only those employed by mining operations located in Elko County.

Notes:
6 Mining employees included in agriculture, forestry, fisheries mining category in 1980 Census.
7 Calculated using 1977 figure and Dept. of Employment Security figure for Elko County.
8 Transportation, Communication, Public Utilities
9 Finance, Insurance, Real Estate

the local economy through purchases of goods and services estimated at $78 million in 1991 and a total of $677 million since 1982 (USDA, USFS 1992b).

A recent wage survey conducted by the state labor department found that miners in Nevada earned an average of $38,752 in 1991, compared to an average salary of $14,850 for those employed in the retail trades industry (Elko Daily Free Press, Feb.2, 1993). The 1989 median family income for Elko County was $38,900 (U.S. Bureau of the Census 1990), 20 percent higher than the national family median income of $32,448 for that year (U.S. Department of Labor 1992).

Figure 3.2
Employment By Industry
Elko County, 1977-1990



Source: [1] Socioeconomic Component, Technical Report, Jerritt Canyon EIS, 1979.
[2] US Bureau of the Census, Census of Population & Housing, 1980.
[3] Socioeconomic Technical Report, Betze Project EIS, ENSR, 1991.
[4] US Bureau of the Census, Census of Population & Housing, 1990.
[5] Anastassatos, Geo., Department of Employment Security. This figure includes only those employed by mining operations located in Elko County.

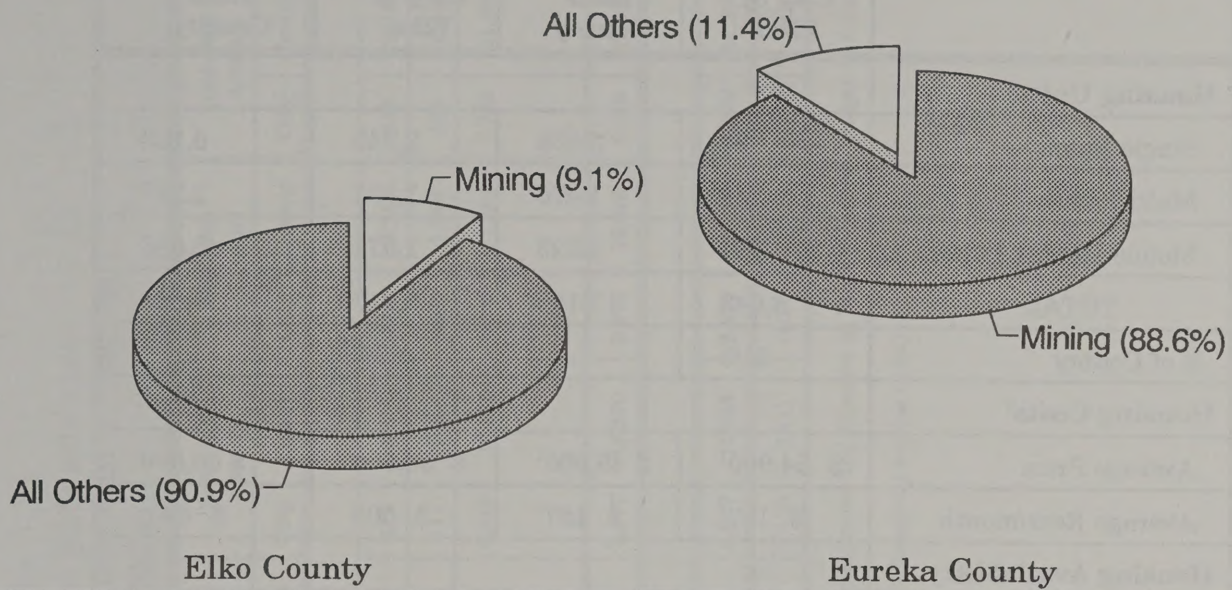
Note: FIRE - Finance, Insurance, Real Estate.
TCPU - Transportation, Communication, Public Utilities.

Unemployment in Elko County, consistently lower than in the state and the nation, declined steadily from 5.3 to 4.8 to 4.6 percent respectively for the years 1988, 1989 and 1990 (ENSR 1991), and to 4.4 percent in 1991 (Clark, pers. comm.).

Housing

Along with the substantial increase in population over the last decade, there has been a corresponding increase in new housing construction. Table 3.17 displays housing stock distribution, average costs, and availability in Elko and in the county. Total housing stock increased 53 percent from 1980 to 1990. NENDA estimated the number of total housing

Figure 3.3
Mining Industry Jobs
Elko County and Eureka County, 1991



Source: Nevada Department of Employment Security

units in the county at 13,867, with 5,817 located in the City of Elko and 890 units in Carlin (NENDA 1992b).

Most of the new subdivision and housing development activity has occurred in the City of Elko (Boucher, pers. comm.). Housing starts slowed in 1992 and there are existing subdivisions within the city that have additional lots to be developed (Lipparelli, pers. comm.).

The Spring Creek area south of Elko is platted for a total of 5,409 lots with 3,940 designated for single-family units and 1,469 designated as mobile home lots (ENSR 1991). Eighty-one percent of the mobile home lots and 19.9 percent of the single-family lots were occupied as of June 1990 (ENSR 1991).

Table 3.16 indicates average housing unit prices of $90,000 for the City of Elko and $60,000 for the county as a whole during 1990. The housing stock in Carlin consists of 363 single-family dwellings, 69 multi-family units, and 458 mobile homes (NENDA 1992b). Average price for a single-family home in Carlin is $60,000 and average apartment rent is $450.00 (NENDA 1992a).

Table 3.17
Housing Availability in Elko County 1980 to 1990

	1980		1990	
	City of Elko	Elko County	City of Elko	Elko County
Housing Units[1]				
Single Family	2,130	3,906	2,943	6,128
Multi Family	759	1,470	1,303	2,247
Mobile Homes, Other	754	1,823	1,571	5,086
TOTAL	3,643	7,199	5,817	13,461
% of County	51%		43%	
Housing Costs[2]				
Average Price	$ 54,900[1]	$ 49,900[1]	$ 90,000	$ 60,000
Average Rent/month	$ 177[1]	$ 157[1]	$ 500	$ 450
Housing Availability				
Rental Vacancy Rate[1]	10%	11%	8.4%	11.1%
Houses for Sale[1]	19	65	64[2]	45[2]

Sources: [1] US Bureau of the Census, Census of Population & Housing, 1980 and 1990. (Elko County Board of Realtors had the following MLS active listings as of Nov. 25, 1992: 32 homes for sale in Elko; 44 homes for sale elsewhere in the county.)
[2] Business Portrait of Northeast Nevada, NENDA 1992.

Available temporary housing includes 1,739 hotel/motel units (NENDA 1992b) and over 1000 RV spaces in five RV parks in the City of Elko. Carlin has 17 motel units and 83 RV spaces (ENSR 1991).

Financial Resources

Revenues and expenditures for Elko County and the City of Elko for fiscal years 1985-86 through 1990-91 are included in Table 3.18. The greatest increase in revenues from 1985 to 1991 came from property taxes, which increased 299 percent for the county and 233 percent for the city during this period. The significant growth in property tax revenues is due to increases in net proceeds taxes from mining and increased taxable valuation associated with additional mining and development-related activity throughout the county (ENSR 1991).

Table 3.18
Revenues and Expenditures
City of Elko and Elko County, 1985-1991 [1]
($000's)

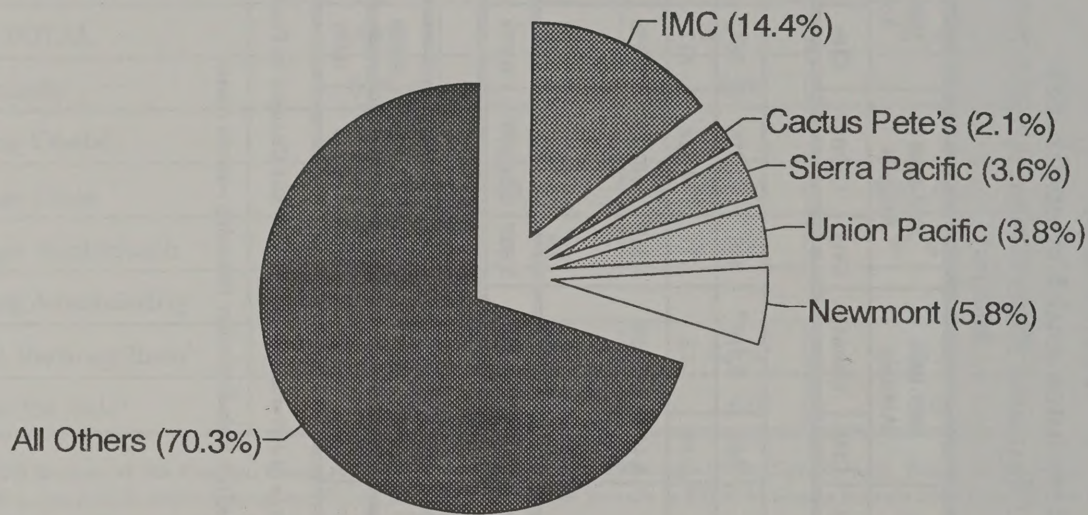
	1985-1986 Actuals		1986-1987 Actuals		1987-1988 Actuals		1988-1989 Actuals		1989-1990 Actuals		1990-1991 Actuals		1985-1991 % Change	
	City	County	City	County	City	County	City	County	City	County	City	County	City	County
Revenues														
Property Taxes	259	936	276	1,472	369	2,616	417	2,376	764	3,261	839	3,740	+223%	+299%
Other Taxes	376	529	461	404	584	13	711	1,618	817	1,990	525	2,049	+40%	+287%
All Other Sources[2] (Including Inter-governmental Resources)	4,140	6,075	4,221	6,747	5,444	7,688	6,849	10,376	7,692	11,264	7,782	11,886	+88%	+96%
TOTAL	**4,775**	**7,540**	**4,958**	**8,623**	**6,397**	**10,317**	**7,977**	**14,370**	**9,273**	**16,515**	**9,146**	**17,356**	**+92%**	**+134%**
Expenditures														
TOTAL	**4,686**	**8,357**	**5,108**	**12,918**	**6,269**	**19,051**	**6,547**	**11,933**	**9,679**	**18,813**	**12,564**	**17,356**	**+168%**	**+108%**
Excess or (Deficiency)[3]	89	(817)	(150)	(4,295)	(128)	1,266	1,430	2,411	(406)	(2,298)	(3,417)	319		

Source: [1] Nevada Department of Taxation, Combined Statements of Revenues, Expenditures and Changes in Fund Balances - Budget & Actual.
[2] Including Intergovernmental resources.
[3] Excess or (Deficiency) of Revenues over Expenditures, not including other financing sources (uses).

Note: Figures are rounded to the nearest thousand.

Property taxes provided 21 percent of 1990-91 county revenues, with IMC, the largest taxpayer in the county, accounting for approximately 20 percent, or $1,100,000, of all property taxes collected in 1990 (USDI, BLM 1991b). In 1991-1992, IMC was again the top property taxpayer, accounting for 14.43 percent of property taxes paid to the county (Johnson, pers. comm.). Figure 3.4 illustrates the 1991 distribution of property tax burden in Elko County.

Figure 3.4
Percentage of Property Tax Burden Elko County, Nevada, 1991-1992



Source: Elko County Assessor's Office

IMC paid $1,460,000 in net proceeds taxes in 1991 (IMC 1992g). Table 3.19 displays the amounts paid by IMC for sales and use taxes, property taxes, and net proceeds taxes from 1987 to 1991, with a total of $5,096,000 paid for these taxes in 1991. In addition to state and local taxes, $8,314,880 was paid in 1991 by IMC and its employees for federal income tax withholding, FICA and FICA medical withholding, and matching FICA and FICA medical contributions (Cumming, pers. comm., 1992).

Elko was particularly affected by the growth of the mining industry in Elko and Eureka Counties during this period and experienced the majority of the population-related impacts (ENSR 1991). The city has had to rely heavily on mining companies' contributions

Table 3.19
Taxes Paid By Independence Mining Company
1987-1991, $000's

TAX	1987	1988	1989	1990	1991
Sales & Use Tax	1,918	2,982	3,720	1,905	2,536
Property Tax	566	467	1,100	1,100	1,100
Net Proceeds Tax	1,467	1,188	920	1,440	1,460
TOTAL	**3,951**	**4,637**	**5,740**	**4,445**	**5,096**

Source: Independence Mining Company, Information Handbook, 1992.

to meet infrastructure needs (ENSR 1991). Area mining companies have reacted positively to the needs of the community, providing both funds and resources to Elko and the county (USDI, BLM 1991b). IMC made 657 donations totalling $669,170 to various entities from 1979 to 1991 (IMC 1992g).

Public Facilities and Services

A summary of public facilities and services infrastructure for Elko County and the cities of Elko and Carlin is displayed in Table 3.20. Increased demand on public facilities and services has resulted in infrastructure expansion and capital improvements such as a new Law Enforcement Center, built in Elko in 1988, which houses the county jail with a prisoner capacity of 115. Average daily inmate population was 68 in September 1992, down from 88 in 1988-1989 (Watson, pers. comm.).

Public water and sewer systems in Elko and Carlin are adequate for current populations and have capacity for additional growth. The city of Elko has implemented an extensive series of street improvement projects with $2.5 million in general obligation bonds (Lipparelli, pers. comm.). The city is seeking federal funds to alleviate traffic congestion on Idaho Street. Other public facilities and services such as fire protection, medical, emergency response, recreation and library are adequate to meet demands.

The Elko County School District includes 19 schools with a total September 1992 enrollment of 8,713 (Elko County School District). September 1992 enrollment exceeded capacity at Elko High, Elko Junior High and at three of the five elementary schools in Elko.

September 1992 enrollment at Carlin Combined School was 500, up slightly from 491 in June 1992 (Elko County School District). Table 3.21 displays September 1992 district enrollment statistics and building capacity percentages.

Table 3.20
Summary
Public Facilities and Services Infrastructure
Elko County, Cities Of Elko and Carlin

Facility or Service	Elko County	City of Elko	Carlin
Law Enforcement	Sheriff's Department - 42 deputies, 14 jail staff, 3 criminal investigators, 8 administrative staff (1992). Elko Law Enforcement Center built 1988; houses county jail with prisoner capacity of 115. Average: 68 inmates per day, Sept. 1992.	City Police Department - serves incorporated area. 32 sworn officers, 4 clerical, 2 animal control, 10 communications (supported by interlocal agreement with county).	Carlin Police Department - 6 sworn officers, 1 animal control, 1 part time secretary.
Fire	Northeastern Nevada Fire Protection - serves unincorporated Elko and Eureka counties with 7 paid staff and 27 volunteers. Nevada Division of Forestry also provides service to the county with 8 paid firefighters.	Elko Fire Department - automatically responds to all calls within 3 mile radius. Mutual aid agreements with Nevada Division of Forestry, Carlin, Wells, and the county. Fire Insurance Rating of IS-05. Staff: 15 paid firefighters (all EMTs), 3 clerical, 21 volunteers (some EMTs). Two facilities, 3 1000+ gallon pumper/fighter trucks, 4 smaller pumpers.	Volunteer fire department has 25 firefighters including EMTs.
Medical and Emergency	Elko General Hospital (operated by county), 50 beds, 215 staff, 24 hour emergency room, obstetrics, surgery, general. Annual average occupancy is 47 to 57% (1991). State Emergency Medical Services provides ambulance service out of Elko office. Two ambulances, volunteer EMTs and RNs (assisted by Sheriff and Fire Departments when necessary).	Elko General Hospital, alcohol and drug abuse treatment center, mental health facility, public health nurse, state rehabilitation services.	Elko General Hospital.
Water Supply	Sources include springs and wells. County provides management assistance to water districts and unincorporated towns. Spring Creek has its own community water and hydrant system.	Municipal wells; 15 million gallon storage reservoir. Peak demands range from 12 million gpd in summer to 3 million gpd in winter. Water system managed as an enterprise fund, supported by user fees.	Water system has capacity for population of 5,000.
Sewage Treatment	Private septic systems, lagoons, disposal ponds.	Sewer service provided within city limits. Front end capacity expanded to handle a population of 25,000 (1992). Biological side of plant slated for expansion to this capacity in 1993. Sewer system managed as an enterprise fund, supported by user fees.	Sewer system has capacity for population of 5,000.
Solid Waste	A new regional city/county landfill is under review	A new regional city/county landfill is under review.	City operated landfill opened in 1989.

Table 3.20, Continued
Summary Public Facilities and Services Infrastructure
Elko County, Cities Of Elko and Carlin

Facility or Service	Elko County	City of Elko	Carlin
Schools	Elko County School District includes 19 schools with a total Sept. 1992 enrollment of 8,713. Elko High, Elko Jr. High, and 3 Elko Elementary schools are over-capacity. A new high school is under construction in Spring Creek. A pay-as-you-go school building program is in effect with modular units used where needed until new facilities are completed.	Elko Grammar No. 2, Southside Elementary, Mountain View Elementary, Elko Jr. High, Elko Sr. High are all over-capacity (Sept. 1992). A new junior and senior high schools are scheduled for construction.	Carlin Combined School (K-12) at 95% capacity, Sept. 1992.
Recreation	Various services and facilities operated by municipal recreation departments and private groups. County operates County Fairgrounds.	Four city parks include: 6 tennis courts, 2 ballfields, 2 softball fields, 2 soccer fields, 2 outdoor basketball courts, 1 handball court, children's play areas, skating rink berms, indoor/outdoor heated swimming pool, softball complex. The municipal golf course is supported by user fees. The convention center is supported by percentage of room-tax receipts.	One city park/playground, 1 archery range, 2 baseball fields, 1 tennis court, 1 volleyball court.
Library	Elko County Library serves Elko, Eureka, White Pine and Lander Counties. Main library is in Elko, with 7 branch libraries staffed part-time. Two bookmobiles provide service to outlying areas.	City served by Elko County Library, main branch is in Elko.	Served by Elko County Bookmobile.
Power and Communications	Sierra Pacific Power Company is the major electricity supplier. California Pacific National is the major telephone supplier. Cellular telephone service is supplied by Alltel Mobile Communications, Inc.	Same as Elko County for electric and telephone service. Southwest Gas Company provides natural gas.	Same as Elko County for electric and telephone service. Same as the City of Elko for natural gas.
Transportation	Interstate 80, the main east-west route, passes through Carlin, Elko, Wells, Wendover. US Hwy 93 runs north-south, linking Wells and Twin Falls, ID. State Hwy 225, the main local north-south route connecting Elko, Mountain City, Owyhee, is in generally good condition, with 26 to 28 foot widths; eligible for federal funding. Elko County maintains 1,200 miles of mostly gravel roads; supported by gas tax proceeds.	The city has implemented an extensive series of street improvement projects with $2.5 million in general obligation bonds (1992). The city is seeking federal funds to install 6 traffic signals on Idaho street. Elko Municipal Airport handles 11 public flights daily. Plans to extend runway and upgrade load-bearing capacity are under review.	Streets are maintained by the city.

Source: Elko County, City of Elko, City of Carlin, Elko County School District.

Table 3.21
Selected Enrollment Statistics
Elko County School District
Fall 1992

School	Grades	# of Students[1]	Capacity[2]	% Capacity[3]
Elko Grammar No. 2	K-6	529	510	104%
Southside El.	K-6	690	650	106%
Northside El.	K-6	512	550	93%
Mountain View El.	K-6	948	660	144%
Spring Creek El.	K-6	591	650	91%
Sage Elementary[4]	K-5	455	470	97%
Elko Jr. High	7, 8	952	600	159%
Elko Sr. High	9-12	1,606	1,200	134%
Carlin Combined	K-12	500	525	95%

Sources: [1] Elko County School District, enrollment figures at end of September, 1992.
[2] Building capacity figures from ENSR Socioeconomic Technical Background Report, 1991:2-17.
[3] Calculated by dividing September 1992 enrollments by building capacities.

Notes: [4] Sage Elementary consists entirely of mobile units (Elliott, pers. comm.)

Mountain View Elementary School was built in Elko during 1991 and construction of two additional elementary schools will commence in 1993 (Elliott, pers. comm.). Mobile units are being used at several locations to provide additional classroom space with Sage Elementary consisting entirely of mobile units (Elliott, pers. comm.). A new high school opened in Spring Creek in September 1993, which is also housing Spring Creek Junior High students (grades 7 and 8) (Knutson, pers. comm.). A second senior high and junior high are to be built in the near future in the City of Elko (Elliott, pers. comm.). All new school construction takes place on a pay-as-you-go financing plan with the necessary funds collected from ad valorem taxes prior to building (Elliott, pers. comm.).

Average 1990 ACT scores for Elko County public schools were 20.8, just slightly less than the state average of 21.0 (NENDA 1992a). The national average ACT score in 1989 was 18.7 (NENDA 1992a). In 1990, Elko County students had higher average scores on both the math and verbal sections of the SAT than other public school students statewide in 1990, and nationwide in 1989 (NENDA 1992a).

The main campus of Northern Nevada Community College, located in Elko, offers post-secondary courses leading to associate degrees in the arts, sciences, and applied

sciences. Average annual enrollment is around 2500 and the staff includes 34 full-time and 250 part-time instructors (NENDA 1992a).

Transportation and Energy

Interstate 80 traverses Elko County east-west, passing through Carlin, Elko, Wells and Wendover. US Highway 93 runs north-south, linking Wells and Twin Falls, Idaho.

The Jerritt Canyon mining operations are located several miles west of State Highway 225, a main north-south highway serving the area. This highway, a secondary road eligible for federal funding, is in generally good condition with road widths varying from 26 to 28 feet. Access to the mill and tailings pond area is by a private road that intersects Highway 225 approximately two miles north of Haystack Ranch. Transport of hazardous materials and oversize loads over state highways is subject to Nevada Department of Highways regulations.

Use of petroleum fuel products by IMC is conserved by busing employees from Elko to the mine site. The mine operations currently use the following petroleum products in daily operations: 400 gals./day gasoline; 15,000 gals./day diesel; 600 gals./day oil.

Other Communities in Elko County

Tuscarora is the only community in the Independence Valley. The Project area borders the east side of the valley, which lies about 50 miles north of Elko. Public facilities are minimal in this area, with the exception of one public school (K-8) on Nevada Highway 226. High school students from Tuscarora and the Independence Valley attend school in Elko (Elliott, pers. comm.). The population of Tuscarora has remained relatively stable over the past decade (Boucher, pers. comm.).

Mountain City is an unincorporated community of approximately 75 people located about 80 miles north of Elko on Nevada Highway 225. A mobile home park for 40 units is undeveloped (USDI, BLM 1989). Public facilities are minimal and students attend school in Owyhee on the Duck Valley Indian Reservation. Some high school students board with families in Elko to attend Elko High School (Elliott, pers. comm.).

The Duck Valley Indian Reservation is located on the Nevada/Idaho border. The town of Owyhee, Nevada, is the central community on the reservation. The reservation is under the jurisdiction of the Shoshone-Paiute Tribal Council which provides facilities and services, with technical assistance provided by the Bureau of Indian Affairs (McDade, pers. comm.).

Other major communities in Elko County which are not addressed in detail in this document include: Jackpot, Wells and West Wendover. It appears that these communities have not been affected directly by mining activities because of their distance from mining sites (in excess of 50 miles). As previously discussed, Elko and Carlin have experienced the most mining related growth over the last decade.

3.6 Visual Resources

Visual resources were identified through public and agency scoping as an issue to be analyzed in this FEIS. The analysis area for visual quality is the Independence Range (See Map 3.13), which is the CEA province for cumulative effects analysis.

The southern portion of the Independence Range within the Mountain City Ranger District is relatively isolated. It is accessible via unimproved forest roads from Highway 225 to the east and Highway 226 to the west. Public use of the region is low with users falling into the following categories:

- IMC mine employees and individual miners and prospectors
- ranchers
- hunters
- fishermen
- wood cutters
- campers and picnickers

Undisturbed areas within the Project area include mountainous terrain from moderate rocky slopes to cliffs. Foothills and valleys on the west side of the Independence Range slope down to the nearly flat Independence Valley. The majority of the Project area consists of sagebrush and grasslands with small areas of aspen and willows. Overall, the Project area is not as visually diverse as the area to the north, which includes Jack's Peak with an elevation over 10,000 feet. The Jack's Peak area is displayed as a partial retention area on Map 3.13.

The visual resources of the Independence Mountain Range have been assessed by the USFS and Visual Quality Objectives (VQOs) have been established (Carlson, pers. comm.; USFS VQO map, March 1993). VQOs are designed to provide objectives for visual management of the land. The USFS visual management objectives for the Independence Range province and the Project area are displayed on Map 3.13 and in Table 3.22. These objectives can be defined as: Preservation, which allows ecological changes only; Retention, which provides for management activities which are not visually evident; Partial Retention, which provides for management activities subordinate of the characteristic landscape; Modification, which provides for management activities that visually dominate the original characteristic landscape; and Maximum Modification, which allows activities that alter the vegetation and landform and dominate the original characteristic landscape with some limitations. The TOC for visual quality is any change in retention and partial retention VQO classes. The Project area has been classified as an area with a maximum modification VQO (Map 3.13).

VQOs are based on several factors, including the public's concern for scenic quality (sensitivity levels), where the area is viewed from, and the diversity of natural features. The sensitivity level evaluation is based on the number of viewers an area has, their reason for being in a position to view the area, and the duration of their viewing.

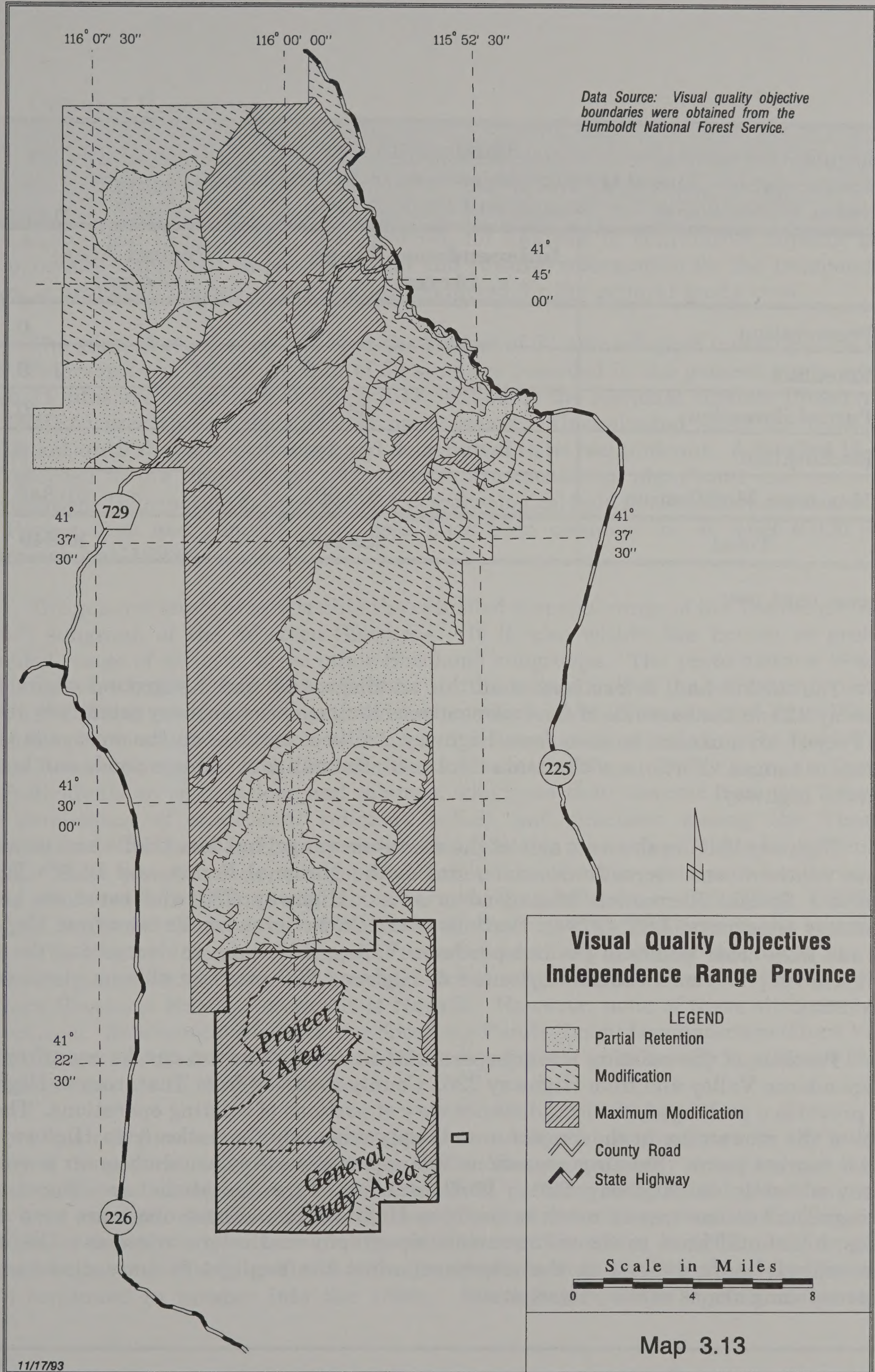

116° 07' 30"
116° 00' 00"
115° 52' 30"
Data Source: Visual quality objective boundaries were obtained from the Humboldt National Forest Service.
41° 45' 00"
41° 37' 30"
41° 37' 30"
41° 30' 00"
41° 22' 30"
729
225
226
Project Area
General Study Area
Visual Quality Objectives
Independence Range Province
LEGEND
Partial Retention
Modification
Maximum Modification
County Road
State Highway
Scale in Miles
0
4
8
Map 3.13
11/17/93

Table 3.22
Visual Quality Objectives in Independence Range and Project Area

	Independence Range (Acres)	Project Area (Acres)
Preservation	0	0
Retention	0	0
Partial Retention	36,025	0
Modification	93,314	0
Maximum Modification	103,591	10,849
Total	**232,930**	**10,849**

Source: USFS 1993.

The USFS had determined that the middleground and foreground views from Highway 225 on the east side of the Independence Range have a primary sensitivity rating. The Project area cannot be seen from Highway 225 because it is on the west side of the mountain ranges. Portions of the main haul road, the mill and tailings ponds can be seen from the highway.

Highway 226, on the west side of the mountain range, has less traffic and primarily serves ranchers and recreationists en route to the National Forest and BLM's Wilson Reservoir Special Recreation Management area. Highway 226 was rated as having secondary sensitivity (ERT 1979e). Portions of the Project area can be seen from Highway 226 and from other points in the Independence Valley, including residences and the town of Tuscarora. The north-south alignment of Highway 226 provides oblique views of the mountains.

Portions of the existing mining operations in Jerritt Canyon can be seen from the Independence Valley and from Highway 226. County road 734 from Tuscarora to Highway 226 provides a prolonged, but long distance view of portions of existing operations. The top ridge of the mountains in the Project area is approximately five miles from Highway 226 at the nearest point. Existing operations are apparent to the casual observer travelling south or north on Highway 226. Portions of existing operations are more easily distinguished as one travels north to south on Highway 226. These areas are seen as fill slopes, horizontal lines in the mountainous topography and color variations. Disturbed areas appear more distinct in the afternoon, when the sunlight is more direct on the western-facing slopes of the Project area.

3.7 Cultural Resources

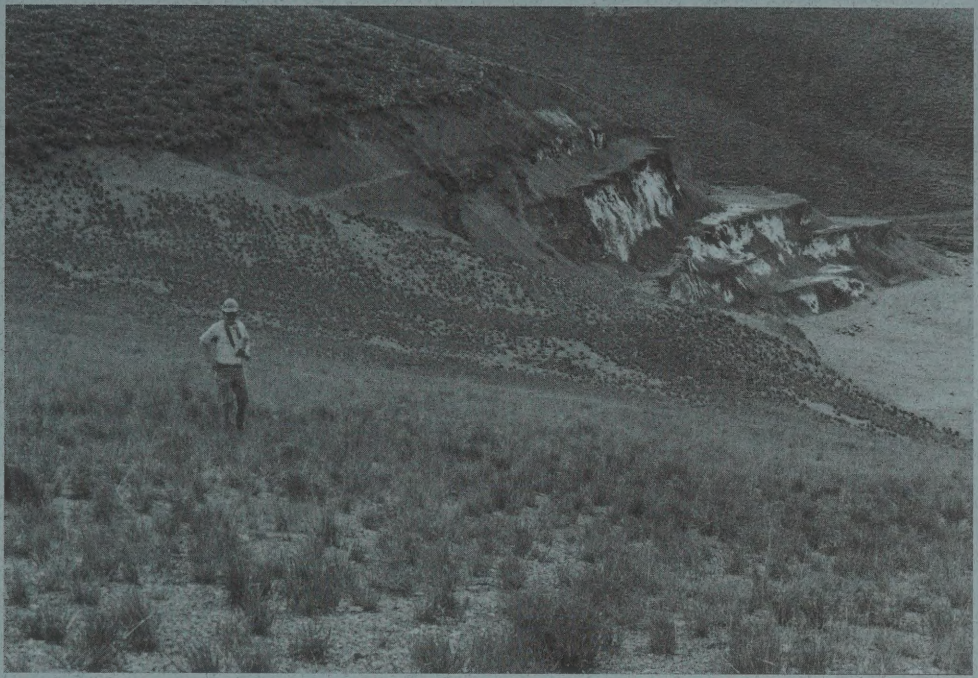
Cultural resources, such as historical or archeological sites or areas with religious or cultural significance to Native Americans, were identified through public and agency scoping as concerns. The analysis area for cultural resources is the general study area with emphasis on the Project area. The province for analysis of cumulative impacts is the Independence Range but the archeological and cultural information for the Independence Range is primarily limited to the studies conducted for the general study area.

The general study area has been the subject of 57 archeological investigations since 1979 (Peterson et al. 1993). A total of 68 sites are recorded in the general study area, of which 11 sites are considered significant as defined by the National Historic Preservation Act (NHPA) and 16 are classified as unevaluated. Unevaluated sites are treated as significant until they are evaluated and determined to be insignificant. A total of 13 sites are recorded in the Project area. Three sites are considered significant and one site is unevaluated. Information gathered from the archeological field investigations indicates that the Project area and general study area have been occupied for at least 6,000 years (Peterson et al. 1993).

The general study area is within the extended seasonal range of the Tosawihi ("White Knife") subgroup of the Western Shoshone. It is also within the known or probable extended range of at least three other Shoshone subgroups. The proto-historic Western Shoshone were hunters and food collectors. In the second half of the nineteenth century, the United States government negotiated two treaties with the Tosawihi and other Western Shoshone people which resulted in relocation to various locations including the Duck Valley Indian Reservation north of the Independence Mountain Range. Today there are families and individuals on reservations and colonies, who trace their descent from the Tosawihi. The persistence of traditional religious beliefs and practices among the Tosawihi descendants is evidenced by the importance they place on areas they hold to be particularly sacred. These areas include springs, mountain peaks or other prominent landforms and places where medicinal plants and minerals can be found (Peterson et al. 1993). USFS and religious leaders of descendants of the Tosawihi toured the Project area in the summer of 1993. The Western Shoshone Historic Preservation society declared that there are sites within the general study area that have significant religious and cultural importance to the Western Shoshone Native Americans of Nevada. However, none of these sites are in the Project area. Representatives from the Shoshone-Paiute Tribal Headquarters (Duck Valley Indian Reservation) also orally indicated that no religious or culturally significant Native American sites are in the Project area.

Livestock production and mining are two additional major forces in the cultural history of the general study area since the 1850s. The general study area has been the site of both cattle and sheep grazing. Until the 1980s, precious metals mining in the general study area was limited in comparison to the gold and silver mining operations in Tuscarora. Gold placer deposits were discovered in what became Tuscarora in 1867. Just as placer deposits began to decline, significant lode silver deposits were discovered and the Tuscarora camp continued to prosper into the 1880s. Mining and related operations continued

sporadically in Tuscarora from the late 1880s to the present (Peterson et al. 1993). Additional specific information on mining and grazing in the general study area and Project area is included in the section of this Chapter titled "Land Use."



Chapter 4

Environmental Consequences

Photo Description: Partial pit backfill and 3:1 slopes at Pattani (Summer 1993).

CHAPTER 4
ENVIRONMENTAL CONSEQUENCES

4.0 ENVIRONMENTAL CONSEQUENCES

4.1 Introduction

This section analyzes and describes the potential consequences to the environment that could result from implementing the proposed Project and each of the alternatives that are described in Chapter 2. A comparison of impacts for all alternatives is also presented in Chapter 2.

The scope of impact analysis includes evaluation of potential impacts resulting from the proposed expansion. The existing disturbances addressed under the No Action Alternative provide a baseline against which the action alternatives can be compared. Anticipated environmental effects from implementing the various alternatives are quantified where possible. Where special conditions make quantification impracticable, efforts have been made to accurately describe differences in terms of significance, magnitude, or duration of environmental effects. Where appropriate, the descriptions distinguish which effects are direct, indirect, cumulative, long-term, short-term, irretrievable, and irreversible. Direct effects are those that occur at the same time and place as the proposed activity. Indirect effects occur later in time or are farther removed in distance. Cumulative impacts analysis includes the collective impacts of past, existing, proposed and reasonably foreseeable actions. Short-term effects are defined as those that would generally not last longer than the life of the Project, estimated at approximately ten years. Long-term effects are defined as those that persist beyond the life of the Project and, according to the CEA model, includes pits, angle of repose waste rock dump slopes, and haul roads. Irretrievable commitments of resources are those that are lost for a period of time. Irreversible commitments of resources are those that cannot be reversed except perhaps in the extreme long term. The mine pits and precious metal extraction would constitute irreversible commitments.

The discussion of effects is primarily directed to those issues and concerns raised throughout the course of the NEPA process and presented in Chapter 1. These include potential adverse environmental effects, technical and engineering considerations, and positive impacts. The process of prioritizing issues from public and agency comments is consistent with the requirements of NEPA. USFS NEPA implementation procedures require that an EIS be comprehensive, concise, issue-oriented, and understandable to the general public.

4.2 Physical Environment

Location and Topography

The Project area is the area of analysis for direct, indirect, and cumulative changes to topography. Cumulative changes are considered over a time period coinciding with the closure of all reasonably foreseeable mining activities and reclamation. Changes in topography would occur under all action alternatives and would affect many of the resources addressed in this FEIS. The type of topographical change affects the total area of disturbance. For example, angle or repose slopes would impact a smaller area than the area that would be impacted by 3H:1V slopes.

Alternative A - No Action

Under the No Action Alternative, changes to topography would be the same as those for existing and approved operations. Permanent changes would be limited primarily to pits and waste rock dumps. Approximately 139 acres of the existing 720 acres of pits have been partially backfilled. Under existing and approved operations, waste rock dumps comprise a total of 708 acres.

Effects Common to All Action Alternatives

The action alternatives for mine expansion would alter the existing topography in the Project area. The pits and dumps constitute the majority of permanent topographical change. Other long term changes would include any remaining low grade ore stockpiles, road portions that are not fully recontoured or that are retained for public access, and any facilities that may remain on privately owned land after mining operations cease.

Pit shapes are the same for all action alternatives with the exception of Alternative F, which does not include surface mining of New Deep. Pits comprise a total reasonably foreseeable development of 1332 acres for Alternatives B, C, D, E and G. Three pit operations are proposed: the New Deep, Saval and Steer, and Burns Basin expansion. If reasonably foreseeable development is realized, the pit shapes would be those displayed on Map 2.2 in Chapter 2. It is probable that actual pit development and final size would be smaller than that displayed on Map 2.2. Under the reasonably foreseeable future development, the New Deep pit would be 527 acres; the Saval and Steer pits would be 711 acres; and the Burns Basin expansion would comprise approximately 94 acres. Pit depth is anticipated to be 1,180 feet in New Deep, 820 feet for the Saval and Steer pits and 340 feet for Burns Basin. Partial pit backfilling would be used wherever feasible under any alternative, including in existing pits outside of the Project area.

Under all action alternatives, the waste rock dumps would result in changes to the existing steep, dissected topography. Existing slopes greater than 40 percent comprise more than half of the proposed disturbance area for waste rock dumps under any alternative. Once the waste rock dumps are complete, less than a quarter of the area would have slopes greater than 40% under any alternative. The majority of the waste rock dump area would

consist of the relatively flat surface at the top of the waste rock dumps, however the proportion of flat surface to sloped surface varies among alternatives. Existing and post-mining slope areas for proposed waste rock dumps are displayed for each action alternative in Table 4.1. The height of the completed waste rock dumps would be virtually the same for all alternatives.

Table 4.1
Existing and Proposed Post-Mining Topography in Waste Rock Dump Area by Alternative (in Acres)

Percent Slopes	Alternative					
	B	C	D	E	F	G
0-10%						
Pre-Mining	34	33	24	22	16	35
Post-Mining	1,032	1,065	889	916	552	1,045
10-20%						
Pre-Mining	123	135	122	104	82	127
Post-Mining	0	0	0	0	0	0
20-40%						
Pre-Mining	410	428	466	421	262	415
Post-Mining	0	73	503	278	0	0
40-60%						
Pre-Mining	521	550	561	517	253	525
Post-Mining	0	26	0	26	0	0
60% or Greater						
Pre-Mining	220	242	241	234	117	221
Post-Mining	276	224	22	78	178	278

Source: USFS GIS data June 1993

Note:

relatively flat = 0-10%
3:1 slopes = 33%
2:1 slopes = 50%
angle of repose slopes = 77%

The waste rock dumps would cover some existing drainages. Specific impacts to water flow as a result of topographical changes are examined in the Surface Water section of Chapter 4.

Alternative F

Under Alternative F, there would be no surface mining of the New Deep deposit. Changes to topography associated with surface mining and waste rock dumps would be reduced under this alternative compared to all other action alternatives. There is a possibility of some surface subsidence from the underground mining proposed for the New Deep mine area. The potential area of subsidence is estimated at approximately 150 acres and would be a permanent change to the topography.

Topographic changes resulting from the Saval, Steer, and Burns Basin waste rock dumps would be similar to Alternative C.

Cumulative Impacts

Once reclamation is complete, cumulative changes to the topography would primarily be those associated with pits and dumps from the existing and proposed operations. Other cumulative changes would include portions of haul roads that are not fully recontoured, any remaining low grade ore stockpiles, and possible retention of facilities on private land. Any roads that are left open for public access purposes could also affect the post-mining topography.

Geology

The Project area is the area of analysis for direct, indirect, and cumulative impacts related to mineral resources, geochemistry, and geotechnical issues. Potential effects are considered over a time period coinciding with the life of the Project in the short term and in the long term after closure of all reasonably foreseeable mining and reclamation activities. Cumulative changes are considered over a time period coinciding with the closure of all reasonably foreseeable mining and reclamation activities. Issues associated with the geology of the Project area include: 1) effects to mineral resources related to excavation and relocation of waste rock and ore; 2) potential for the waste rock dumps, pit walls, and ore stockpiles remaining after mining to release acidic waters or trace elements; and 3) physical stability of the waste rock dumps.

Mineral Resources

Effects to mineral resources include covering areas containing potential mineral resources with waste rock dumps or other project components and incomplete removal of the total mineral resource as a result of only mining the economic portions of an ore body.

Alternative A - No Action

There would be no impacts on mineral resources in the No Action Alternative other than those analyzed in previous NEPA documents.

Effects Common to Alternatives B, C, E, and G

Effects to mineral resources from Alternatives B, C, E and G include excavation and relocation of approximately 1,084 million tons of waste rock and 20 million tons of ore. The waste rock would be placed in waste rock dumps or used for partial pit backfill when operationally and economically feasible. Potential indirect effects to vegetation, wildlife, water quality and quantity, and other resources are addressed in the appropriate sections of this FEIS.

Alternative D

About 1,084 million tons of waste rock and 20 million tons of ore would be mined under this alternative. However, the configuration of waste rock dumps in this alternative would make it difficult or impossible to access identified mineral resources west of the New Deep pit in the future. Other direct and indirect effects would be the same as Alternatives B, C, E, and G.

Alternative F

Potential impacts on mineral resources due to removal of waste rock for Alternative F would be less than the potential impacts for Alternatives B, C, E and G due to the smaller amount of waste rock that would be excavated and moved in the underground mining of the New Deep deposit. In addition, some of the mineral resources in the New Deep area would remain in the ground after mining as low grade ore that cannot be economically recovered by underground methods. An area above the underground mine could potentially subside. Potential impacts in the Saval/Steer and Burns Basin mine areas include the same pits and waste rock dumps as those discussed for Alternatives B, C, E, and G.

Cumulative Effects

Cumulative effects for mineral resources include the creation of additional open pits, adits, underground workings, and waste piles as ore reserves are removed. Future exploration may identify additional deposits which may be mined by open pit or underground methods.

Geochemistry

The issues associated with geochemistry are the potential for waste rock, pit walls, and ore stockpiles remaining after mining to release acidic water and trace elements. Direct effects to surface and groundwater resources would result if acid were to be generated or

if trace elements were released. Indirect effects to aquatic resources and vegetation would also occur if acid was formed or if trace elements were released.

Alternative A - No Action

If the No Action Alternative is selected, current mining and waste rock disposal activities would continue as currently permitted. The Saval, Steer, and New Deep deposits would not be mined and the corresponding waste rock dumps would not be constructed. Similarly, the Burns Basin pit would not be expanded as currently proposed. There would be no impacts to water and soil resources other than those associated with the geochemical properties of the waste rock material being mined under the existing and approved mining activities.

Effects Common to All Action Alternatives

The potential for waste rock in the Project area to generate acid was evaluated using both static and kinetic test methods, as described in Chapter 3. As a first step in the evaluation process, the results of static testing were used to determine the acid-generating potential of waste rock based on test results expressed in terms of NP/AP ratios. A ratio of 1:1 was used to separate potentially acid forming rock (NP/AP less than 1) from those that fall into a "zone of uncertainty" (NP/AP greater than 1 and less than 3). Those with a NP/AP ratio greater than 3 are considered non-acid generating (see the geochemistry section in Chapter 3). For the purposes of this analysis, samples with an NP/AP value less than 3 are referred to as potentially acid-generating. AP values used in this analysis were calculated using total sulfur values.

Kinetic testing was performed on samples of waste that, based on static test results, had the highest potential to generate acid. The results of this testing are summarized in Table 3.2 in Chapter 3. These test results were correlated with static test results to determine threshold values of percent sulfur and NP/AP ratio for delineating potentially acid producing and non-acid producing waste rock. Based upon these threshold values, it was determined that approximately five percent of the Snow Canyon waste and a high percent of the lower plate intrusives are acid generating. Waste rock comprised of the Roberts Mountains and Hanson Creek Formations has a very low potential to generate acid, with the exception of a very small percentage of highly altered rock, such as decalcified limestone.

More than 90% of the waste that would be produced from the Saval, Steer, and Burns Basin pits is comprised of Roberts Mountains and Hanson Creek Formations. Lower plate intrusive dikes make up one percent or less of waste produced by these pits. Based on the static and kinetic test results, most of the waste rock that would be generated under the action alternatives in the Saval, Steer, and Burns Basin mine areas has a low potential to generate acid. The Snow Canyon makes up about 73 percent of the waste to be mined from the New Deep pit, and approximately two percent of the waste would be comprised of lower plate intrusive. The waste to be mined from the New Deep pit therefore has a higher potential to generate acid. Under Alternative F, the New Deep deposit would be mined

using only underground mining methods. The percentage of Snow Canyon Formation would be lower and the percentage of lower plate intrusive would be slightly higher than the waste produced by the open pit mining of New Deep. However, the volume of waste to be produced is much lower than that produced by open-pit mining.

IMC has developed a waste rock characterization and handling program for identifying and handling potentially acid-forming waste (Appendix A). The plan will utilize baseline characterization and testing data in combination with geologic mapping in a waste rock model that will be used to delineate high risk zones that have the potential to be acid-forming. These zones are defined as areas of waste that contain lower-plate intrusive rock, Snow Canyon Formation, and some highly altered material in the vicinity of the ore zone. An operational waste sampling and characterization program will identify acid-forming waste within the high risk zones either through visual characterization or geochemical analysis. A verification program will be utilized to verify that waste in low risk zones is not acid-generating. IMC is proposing to use the Net Acid Generation (NAG) method to characterize acid-generating material.

A handling plan has been developed that addresses placement of materials identified as acid-producing. The primary objective of the waste handling plan is to prevent degradation of the waters of the State. This will be accomplished with one or more of the following methods, used alone or in combination: 1) selective handling and isolation of acid-forming waste rock, 2) capping, contouring or drainage control to reduce infiltration, and 3) blending and dilution of acid-generating materials.

Because the waste rock dumps would be constructed in stream channels and in some instances on top of seeps and springs, the potential exists for surface waters to contact waste rock material. The waste rock dumps would be subjected to meteoric water infiltration and runoff as a result of precipitation. Waste rock dump design would include under-dump drainage systems to permit surface water flow through the base of the dumps. Surface water monitoring would continue at the existing stations that are located downgradient of the proposed waste rock dumps. The surface water monitoring results and a discussion of trends in water chemistry would continue to be submitted to the USFS in the Annual Work Plan in July of each year. Other monitoring data would be submitted quarterly. Refer also to Appendix B, Surface Water Monitoring Program.

Effects Common to Alternatives B, C, D, E, and G

Under Alternatives B, C, D, E, and G approximately 1,084 million tons of waste rock would be mined and deposited in waste rock disposal areas. The composition and distribution of rock types within the disposal areas is the same for Alternatives B, C, D, E and G. Disposal areas would include waste rock dumps and partial backfilling of existing and proposed open pits. The existing open pits to be backfilled would not impound water.

Alternatives F and G

Under these alternatives, mining and waste rock dump development in the Saval, Steer, and Burns Basin areas would be the same as the action alternatives discussed above, and the effects to geochemistry in these mine areas would be the same. However, underground mining of the New Deep ore body would result in a smaller quantity of material removed from the underground workings and placed in waste rock disposal areas. The composition of the New Deep waste rock dumps would not be the same as that which occurs under Alternatives B, C, D, and E. The composition of the waste rock material to be removed from the New Deep underground workings would be approximately 43 percent Roberts Mountains Formation, 29 percent Hanson Creek Formation (all units combined), 26 percent Snow Canyon Formation and approximately three percent lower plate intrusives. Static and kinetic test results indicate that some of the waste rock generated by underground mining is potentially acid generating. The results of static and kinetic testing were used to develop a waste rock evaluation program that would guide the handling and placement of the New Deep underground waste rock.

Cumulative Effects

Sampling of springs downgradient of two existing waste rock dumps does indicate that sulfate concentrations are greater than the drinking water standards. However, no baseline data were collected from these springs, therefore an increase in sulfate cannot be verified. With implementation of the Waste Rock Characterization and Handling Plan, cumulative impacts to surface water quality associated with the action alternatives would be limited to the effects described for the existing operation.

Geotechnical Considerations

The primary geotechnical issue is waste rock dump stability. As indicated in the geology section in Chapter 3, the geotechnical considerations associated with dump stability include: 1) earthquake motions (seismicity); 2) the existence of unstable ground as evidenced by landslides or other movement features; 3) terrain steepness; 4) the clay content of foundation soils; 5) saturated foundation soils and springs; 6) final dump slope steepness; 7) dump material properties; and 8) vegetation within the waste rock dump area.

These geotechnical considerations are used in designing the dumps for seismic stability, mass stability, foundation stability, surface stability, long-term drainage control, and erosion control on waste rock dumps. From a geologic perspective, erosion and mass stability are naturally occurring phenomena; however, the design objective would be to take all practicable and feasible measures to control erosion and mass stability.

Dump stability was considered during the development of all of the action alternatives. Specific design measures responsive to the geotechnical considerations are discussed below.

Alternative A - No Action

Since no new dumps are involved, no new geotechnical considerations other than those previously analyzed would result from this alternative.

Effects Common to All Alternatives

This section discusses the probability and consequences of potential waste rock dump failures. Dump stability analyses indirectly indicate the probability of failure of a project component. The higher the factor of safety, the less potential for failure of the structure. A factor of safety equal to one implies that the structure has sufficient strength to carry the calculated load. Factors of safety less than one indicate that the structure will eventually fail, while factors of safety greater than one imply that the structure is more than strong enough to carry the calculated loads. Most structures are designed with a factor of safety greater than one to include a margin of safety against unknown factors that may affect the strength of the structure or the load it must carry.

There is always a possibility that a designed waste rock dump may fail. The consequences of failure of project components are addressed in this section as a means to evaluate alternative waste rock dump configurations. Although there are potential risks inherent in construction of waste rock dumps, based on the stability analyses conducted, they are not predicted to occur.

Factors of safety are calculated for two different unsaturated conditions: static and pseudostatic. A static factor of safety measures the strength of the waste rock dumps under anticipated conditions. Pseudostatic safety factors relate to the ability of a waste rock dump to withstand an earthquake.

The consequences of failure of the project components are a function of the size and location of the structure. The effects to a waste rock dump face would vary with the size and nature of the failure. A small slump located on a dump face may affect the vegetation growing on the face but would have no other effects. A major failure, however, could potentially block the under-drain or result in sedimentation impacts downstream. The length to which the dump material would be transported downstream from the toe of the dump has not been calculated, but would vary with the height and slope of the dump face and the slope of the stream channel. Generally, the higher and steeper the dump face, the greater the distance the materials would be transported. Waste rock dump heights are similar for all of the action alternatives. The waste rock dumps for all of the action alternatives would initially be developed at angle of repose. Most of the dump slopes under Alternatives D and E would be reduced to 3H:1V after construction. Some dump slopes would be pushed to 3H:1V under Alternative C. Under Alternatives B, F and G the waste rock dump slopes would be left at angle of repose and be armored with coarse and durable rock. If a major failure were to occur, it would probably travel the farthest under these three alternatives.

During operations, dump failures would be controlled or remediated by IMC with the primary objectives of providing for the safety of equipment operators and minimizing environmental damage.

Seismicity

All waste rock dumps are designed to be stable for an earthquake with a 250 year occurrence interval.

Landslides

The hazard analysis did not reveal the presence of any natural landslides or related features such as debris flows or sinkholes within the area proposed for disturbance under any of the action alternatives. As a result, these potential foundation hazards would not be expected to effect the stability of the dumps under any of the alternatives.

Terrain Steepness

Upon completion of a dump, no unbuttressed angle of repose slope would have a toe foundation that is steeper than 30 percent. Dump slopes would have a minimum safety factor for base sliding of 1.3 as calculated according to U.S. Forest Service Intermountain Region Guidelines (USDA, USFS 1991c). Appropriate engineering design and construction methods would be used to maintain stable dumps during operations. This is required for the safety of operators and equipment.

Foundation Soils

The majority of the soils are sandy and gravelly silts. Soils with horizons dominated by clay are limited in extent and have only been mapped as a narrow band along Jerritt Creek. Therefore, the potential hazard is expected to be low due to the limited extent of clay. Development of toe berms would essentially eliminate any near surface high clay horizons at the downstream toe of the dumps in the drainage bottoms.

The critical portion of final slopes supported by clay would have a minimum stability safety factor that is acceptable to the USFS.

Saturated Foundation Soils and Springs

Design and construction measures would be taken to assure that there is no groundwater development in the dumps from the bottom up and that dumping would not occur on saturated foundations. Under-dump drainage systems or trench drains would be constructed in these areas to drain saturated foundation soils.

The waste rock dumps proposed under Alternatives B, E, F, and G would cover four springs. Waste rock dumps for Alternatives C and D would cover five springs. All of the action alternative waste rock dumps would cover two seeps.

The springs and seeps identified within the drainage bottoms would be covered by a drainage system that results from natural gravity sorting during dumping. Perennial springs located on hillsides outside of the drainage bottoms would be drained by preconstructed foundation trenches that extend to the nearest drainage bottom or beyond the dump perimeter.

Dump Slope Steepness

Erosion potential increases with both slope steepness and slope length. For the same dump height, flatter slopes have longer lengths. Because of differences in material characteristics, the erosion potential for the angle of repose dump slopes is expected to be higher than the natural pre-mining slopes that are steeper than 60 percent.

Erosional stability of the 3H:1V dump slopes would be achieved by revegetation that complies with a specified minimum cover density. Surface drainage and erosional stability of the 2H:1V and angle of repose dump slopes would be achieved by armoring with coarse and durable material. The total acres of post-mining slopes at angle of repose, 2H:1V, and 3H:1V are summarized in Table 4.1.

Dump Material Properties

Coarse and durable materials would be used to armor angle of repose slopes. As the particle sizes become coarser, the chances of erosion and shallow flow slides decrease. Durability provides assurance that the particle sizes would not become smaller in the near future. Coarseness and durability are also needed to maintain internal drainage to prevent saturated zones from developing in the vicinity of the slopes.

The tons of coarse and durable material and the percentage of total dump material that would be required for a 40-foot horizontally thick armor layer for the different mine areas and alternatives are indicated in Table 4.2.

Construction specifications that define suitably coarse and durable materials in measurable terms for angle of repose armor layers and internal drainage systems are being developed to ensure dump stability. Fine grained material can cause differential settlement and disrupt surface drainage. These materials would be placed at approved dump locations.

The selective placement of materials and minimum dumping heights would be implemented to ensure that particle size distributions would continually increase from the crest to the toe of dump slopes so that infiltration will not saturate the embankment from the top down.

The top of the finished dumps would be graded to offset potential settlement and maintain surface drainage away from the dump slopes.

Table 4.2 Summary of Coarse and Durable Rock Volumes by Alternative				
Alternative	Angle of Repose Slope Acreage	Total Waste Rock Mined (tons)	Coarse and Durable Rock Requirements (tons)	Percent of Total Waste Rock Volume
B	276	1,084,000,000	34,146,916	3.2
C	223	1,084,000,000	27,589,718	2.5
D	22	1,084,000,000	2,721,856	0.3
E	78	1,084,000,000	9,650,215	0.9
F	178	631,000,000	22,022,286	3.5
G	278	1,084,000,000	34,394,357	3.2

Source: IMC 1993.

Vegetation

Vegetation would not be removed from the majority of the waste rock dump sites due to the steepness of the natural slopes and the associated operational constraints and safety considerations. Clearing of vegetation would occur during development of the berms along the downstream toes of the lowermost dump levels. Aspen that may affect the performance of the under-dump drain within a 200-foot wide strip centered along the axis of the existing surface drainage channels would be removed in agreement with the USFS. The need for removal of aspen would be determined on a site-specific basis. Leaving vegetation within the remainder of the dumps would not be expected to adversely affect dump stability because the dominant vegetation type is sagebrush/grassland.

Cumulative Effects

If stability is controlled as expected, the geotechnical considerations alone would not result in any specific cumulative effects other than those related to the acreage of surface disturbance.

Soil Resources

The Project area is the area of analysis for direct, indirect, and cumulative effects. Analysis of direct and indirect effects is discussed in terms of short-term and long-term time periods; cumulative effects are analyzed for the long-term. Short-term effects are those that would generally not last longer than the life of the Project. Long-term effects are those that continue after closure and reclamation. Soil availability and suitability for use as growth

medium are components of the reclamation potential focus issue. The availability of soil within the disturbance areas is related to thickness and natural slope steepness. Suitability for use as growth medium is based upon the physical and chemical characteristics of the soil. Application of growth medium to disturbed areas commonly enhances revegetation success.

Effects to soil resources are discussed in terms of changes in soil productivity. Soil productivity is related to the quality and quantity of growth medium applied to disturbed areas, as well as slope aspect and steepness.

Alternative A - No Action

No new impacts would occur to soils under this alternative, other than those analyzed in previous NEPA documents. Currently, there is a surplus of growth medium in stockpiles that would cover about 227 acres of disturbed land beyond that required for existing and approved disturbances. This surplus has not been included in the growth medium availability calculations discussed in the following sections for the action alternatives.

Effects Common to All Alternatives

Short-term losses of soil productivity would occur on disturbance areas to which growth medium would be applied during reclamation. The short-term losses of soil productivity are different for each alternative and would range from 957 acres under Alternative F to 1,691 acres under Alternative D. The short-term losses of soil productivity would exist until growth medium is redistributed and vegetation is established on the disturbed areas. A summary of short-term impacts expressed in terms of the acreage of surface disturbance to which growth medium would be applied and seeded using proven reclamation techniques is presented in Table 4.3.

Long-term losses of soil productivity would occur in disturbance areas which would not have growth medium applied during reclamation operations. The long-term losses of soil productivity vary by alternative and would range from 1,084 acres under Alternative F to 1,691 acres under Alternative G. Pit development would constitute about 803 acres (74 percent) of the long-term impacts for Alternative F and 1332 acres (79 percent) of those for Alternative G. A summary of the acreages that would not have growth medium applied and be revegetated using proven reclamation methods (long-term disturbance) is summarized in Table 4.3.

Indirect effects to soils would be associated with the potential for erosion during mining and effects of waste rock dump stability. During mining and construction operations, dust suppression activities and revegetation would be used to control fugitive dust and wind erosion. Sediment control measures and revegetation of disturbed areas would be used to protect surface water and aquatic resources from the effects of soil erosion. Predicted sediment yields for each alternative compared to pre-mining conditions are described in the discussion of surface water quality. Due to the relatively shallow nature

Table 4.3
Disturbance and Soil Redistribution Acreage Summary

	Alternative						
	A[1]	B	C	D	E	F	G
New Disturbance Area (Acres)	0	2,559	2,662	2,744	2,557	1,777	2,605
Total Disturbance Area[2] (Acres)	2,183	2,966	3,099	3,142	2,952	2,041	3,013
Long Term Disturbance[3] (Acres)	1,081	1,677	1,652	1,451	1,505	1,084	1,691
Cumulative Long Term Disturbance (Acres)	1,081	2,758	2,695	2,532	2,585	2,165	2,772
Short Term Disturbance[4] (Acres)	1,102	1,289	1,447	1,691	1,447	957	1,322
Cumulative Short Term Disturbance (Acres)	1,102	2,391	2,549	2,793	2,550	2,059	2,424
Growth Medium Required (CY)	1,339,012	1,227,535	1,396,775	1,656,237	1,404,950	757,121	1,257,651

Notes: Long term and short term Disturbances are not the same as CEA Long term and Short term Disturbance definitions.
[1] Exploration roads are not included in Alternative A disturbance and reclamation acreages.
[2] Total disturbance area includes overlap with existing disturbance.
[3] Long term Disturbance includes pits, angle of repose dump slopes, and 37.5 % of haul road disturbance area.
[4] Short term Disturbance includes flat dump tope, 70% of pit backfills, 62.5% of haul roads, ore stockpiles, sediment traps, and growth medium stockpiles.

and the limited area of soils with high clay contents, effects of soils on dump stability are expected to be minor. Anticipated soils effects on waste rock dump stability are discussed under geotechnical considerations.

Cumulative short-term losses of soil productivity would vary by alternative and would range from about 2,059 acres under Alternative F to 2,793 acres under Alternative D. Long-term cumulative impacts to soil productivity would vary from about 2,165 acres under Alternative F to 2,772 acres under Alternative G. The existing and proposed pits represent between 1,523 acres (70 percent) under Alternative F and 2,052 acres (74 percent) under Alternative G of these long-term impacts to soil productivity. A summary of short-term and long-term cumulative impacts to soil productivity is presented in Table 4.3.

Growth Medium Availability and Suitability

Direct impacts as well as irreversible and irretrievable losses of soil productivity would be partially offset by recovering suitable materials for use as growth medium from those portions of the pits with slopes of 30 percent or less. The estimated quantity of suitable soils available within the pits is summarized in Table 4.4. These estimates are

based on the area within the pits with slopes equal to or less than 30 percent, depth to bedrock for each soil series, and soil suitability for use as growth medium. The 1.8 million cubic yards of soil estimated to be available for use as growth medium is the same for Alternatives B, C, D, E, and G, since the pit shapes do not change between these alternatives. Approximately 1.1 million cubic yards of growth medium would be salvaged under Alternative F, because the New Deep orebody would be mined using underground rather than open pit methods. Soil series with a poor suitability rating were not included in the calculations. The soils that would be used to develop the berms along the bottom of the waste rock dumps and haul road fill slopes were also excluded from the quantities presented in Table 4.4. It is anticipated that additional soils would be recovered during mining as pit benches are developed on steeper slopes. Recovery of soils from slopes steeper than 30 percent during pit development would focus on areas having deeper soils with a good suitability rating. The presence of aspen would be used as a visual guide to favorable soil conditions during pit development, because the aspen stands are normally associated with the thicker high quality soils.

The goal of the soil removal operations would be to salvage sufficient quantities to cover the acreages specified for each of the action alternatives. A sufficient quantity of suitable growth medium is available on slopes of 30 percent or gentler within the proposed pits to fulfill the growth medium redistribution goals for all of the action alternatives. Growth medium would be recovered from the steeper slopes within the pits, where feasible. The amount of growth medium needed to satisfy the goals for reclamation is summarized by alternative in Table 4.3.

Growth medium stockpile volumes at the existing Jerritt Canyon mining operations are monitored and the results reported to the USFS in the Annual Work Plan submitted by IMC each year. Future growth medium salvaging would be monitored and reported in the same manner. Suitability of growth medium would be based upon visual characteristics during removal and standard soil tests after redistribution.

Reclamation Potential

Reclamation objectives are to return areas disturbed by mining to a stable and/or productive condition. Reclamation activities would provide for physical stability (both mass stability and surface erosion) and revegetation. Reclamation would involve one or more of the following activities: removal of project facilities located on National Forest System lands, grading of waste rock dump tops and/or slopes, armoring angle of repose waste rock dump slopes, application of growth medium, revegetation, and providing for public safety.

Mass stability of the waste rock dumps would be ensured by designing and constructing waste rock dumps with a minimum stability safety factor that is acceptable to the USFS. Mass stability may be further enhanced by reshaping some waste rock dumps slopes to an angle of 3H:1V. Surface stability would be accomplished through coarse and durable armoring of 2H:1V and angle of repose slopes and revegetation of gentler slopes.

Table 4.4
Summary of Soils Available for Reclamation

Soil Association	Total Pit Area[1] (Acres)	Suitable Salvage Area[2] (Acres)	Depth to Bedrock (Inches)	Suitable Salvage Volume[2] (CY)
New Deep Pit				
B	246.14	80.0	32.0	344,113
D	245.32	64.1	42.8	368,788
Subtotal	**491.46**	**144.1**		**712,901**
Saval/Steer Pit				
D	162.99	19.0	42.8	109,215
F	6.72	1.0	42.8	5,984
G	83.69	41.8	42.0	236,257
I	458.37	63.4	54.0	459,994
Subtotal	**711.77**	**125.2**		**811,450**
Burns Basin Pit				
A	19.92	5.8	32.0	24,867
G	20.61	15.9	42.0	89,895
I	42.53	16.2	54.0	117,902
K	2.6	2.6	58.4	20,414
Subtotal	**85.66**	**40.5**		**253,078**
GRAND TOTAL	**1,289.00**	**309.8**		**1,777,429**

Note: [1] Previously disturbed areas excluded from total pit acreages.
[2] Suitable salvage area corresponds to pit acreages with slopes less than 30 percent.

The section on geotechnical considerations discusses physical stability of the waste rock dumps.

Revegetation success is a function of several factors, such as 1) slope steepness, 2) slope length, 3) physical and chemical characteristics of the seedbed, 4) aspect, and 5) climate. Factors 3 through 5 do not vary among alternatives. The differences in revegetated acres are primarily a function of dump slope steepness. The steepness of the

final dump slopes is directly related to revegetation capabilities and was termed "reclamation potential" for the purposes of this analysis.

Waste rock dumps with slopes at an angle of 3H:1V or less can be revegetated using established reclamation methods. Growth medium application, seeding, and related activities can be done on the contour with construction or reclamation equipment. Alternatives C, D and E include 3H:1V dump slopes. Slopes at 2H:1V are too steep to be worked on the contour with machinery. Revegetation of these slopes depends on slope lengths short enough to use specialized techniques such as hand-seeding and hydro-seeding. For the purpose of this analysis, 2H:1V slopes are considered to be armored rather than revegetated. There are minor amounts of 2H:1V slopes under Alternatives C and E.

The amount of disturbed land that would be reclaimed and revegetated to a productive state varies with the acreage of waste rock dump slopes in each slope category and the amount of haul road acreage to be reclaimed. The acreages presented in Table 2.1 were used in calculating the acres to be revegetated as displayed in Table 2.2.

Alternative B

The waste rock dumps would be developed in a series of lifts that progress up the natural drainages. Locating the dumps in this fashion would consolidate the area of disturbance, utilize the natural topography to enhance stability, decrease dump heights, and reduce slope lengths. Angle of repose slopes would range from about 70 to 1,150 feet in length under this alternative.

A total of 2,966 acres (including existing and approved disturbance) would be disturbed under this alternative. Revegetation would take place on approximately 1,358 acres under this alternative. In addition, approximately 138 acres (50 percent) of the angle of repose slopes would be covered with growth medium or fine textured waste rock materials and revegetated. This practice would only be used in those areas where surface erosion or surface failures would have no potential to affect the water quality of area streams. The purpose of this practice would be to encourage revegetation, although it is not possible to predict the degree of success. For this reason all angle of repose slopes, even those treated with growth medium, have been counted as unrevegetated acres (long-term disturbance) in Table 4.3. The remaining 1,608 acres of disturbance would be left in a stable condition but would not be revegetated.

The final shape of the waste rock dumps under this alternative would consist of approximately 1,032 acres (78 percent) of flat waste rock dump tops with slopes of 0-10 percent and 276 acres (22 percent) with angle of repose slopes.

Alternative C

Under this alternative, 3H:1V slopes and terraces would be developed on some of the dumps. A total of 3,099 acres would be disturbed. Approximately 1,468 acres of disturbance

would be revegetated. The remaining 1,652 acres of disturbance would be left in a stable condition but would not be revegetated.

The final shape of the waste rock dumps under this alternative would consist of 1,065 acres (76 percent) with slopes of 0-10 percent, 73 acres (5 percent) with slopes of 3H:1V, 26 acres (2 percent) with slopes of approximately 2H:1V, and 224 acres (16 percent) with angle of repose slopes. Angle of repose slopes would range from about 70 to 900 feet in length. The 3H:1V slopes would range from 205 to 900 feet in length.

Alternative D

This alternative was included to increase the area that could be revegetated by maximizing the area of 3H:1V slopes. Alternative D would require building the waste rock dumps in a series of lifts to allow the slopes to be reduced to 3H:1V. An extension of the under-dump drainage system would have to be constructed from the downstream toe of the waste rock dump to the final limit of the 3H:1V slopes under this alternative to permit water flow through the dumps.

A total of 3,142 acres would be disturbed under this alternative, of which approximately 1,775 acres would be revegetated. The remaining 1,451 acres would be left in a stable condition but would not be revegetated.

The final shape of the waste rock dumps under this alternative would consist of 889 acres (63 percent) with slopes of 0-10 percent, and 503 acres (36 percent) with slopes of approximately 3H:1V and 22 acres (1 percent) with angle of repose slopes. The 3H:1V slopes would range from 140 to 2580 feet in length.

Alternative E

This alternative is similar to Alternative D except angle of repose slopes would be developed on the upstream and downstream faces of the waste rock dumps to promote drainage through the dumps. A total of approximately 2,952 acres of disturbance would occur under this alternative, and approximately the same surface disturbance from waste rock dumps would occur when compared to Alternative B. About 1,503 acres would be revegetated under Alternative E. The remaining 1,449 acres would be left in a stable condition but would not be revegetated.

The final shape of the waste rock dumps would consist of approximately 916 acres (70 percent) with slopes of 0-10 percent, 278 acres (21 percent) with slopes of approximately 3H:1V, 26 acres (2 percent) with slopes of approximately 2H:1V, and approximately 78 acres (6 percent) with angle of repose slopes. Angle of repose slopes would range from about 440 to 1080 feet in length under this alternative. The 3H:1V slopes would range from 141 to 1265 feet in length.

Alternative F

This alternative was included to address the possibility of utilizing underground mining methods in the New Deep mine area. Total disturbance under this alternative would be approximately 2,041 acres, the least amount of total surface disturbance of all of the action alternatives. About 1,060 acres would be revegetated under this alternative. The remaining 981 acres would be left in a stable condition but would not be revegetated.

The final shape of the waste rock dumps would consist of 552 acres (75 percent) with slopes of 0-10 percent, and 178 acres (24 percent) with angle of repose slopes. Angle of repose slopes would be approximately 1.3H:1V. Angle of repose slopes would range from about 72 to 1,250 feet in length under this alternative. There would be no 3H:1V slopes under this alternative.

Alternative G

This alternative would include a combination of underground and open pit mining methods within the New Deep mine area. A total of 3,013 acres would be disturbed under this alternative. About 1,403 acres would be revegetated under this alternative. The remaining 1,610 acres would be left in a stable condition but would not be revegetated.

The final shape of the waste rock dumps would consist of 1,045 acres (79 percent) with slopes of 0-10 percent and approximately 278 acres (21 percent) with angle of repose slopes. Angle of repose slopes would range from about 72 to 1,150 feet in length under this alternative. There would be no 3H:1V slopes under this alternative.

Cumulative Effects

Cumulative short-term effects to soil resources would vary by alternative and would range from about 2,059 acres under Alternative F to 2,793 acres under Alternative D. Long-term cumulative impacts to soil productivity would vary from about 2,165 acres under Alternative F to 2,772 acres under Alternative G. The existing and proposed pits represent between 1,523 acres (70 percent) under Alternative F and 2,052 acres (74 percent) under Alternative G of these long-term impacts to soil productivity. A summary of short-term and long-term cumulative impacts to soil productivity is presented in Table 4.3.

Climatology and Air Quality

The area evaluated for detailed analysis of air resources is the Project area. For analysis of possible air quality impacts on PSD Class I areas, the area evaluated was expanded to include the nearest Class I area, which is the Jarbidge Wilderness area approximately 30 miles (50 kilometers) to the northeast of the Project area. Potential effects are considered for a time period coinciding with the life of the Project.

Impacts on air quality would be considered significant for this analysis if the mining activities would result in exceedences of any of the state or National Ambient Air Quality Standards, or if any of the activities would cause or contribute to an exceedence of any PSD increment. Past ambient air monitoring and dispersion modeling analyses have indicated no such impacts.

Effects Common to All Alternatives

The air pollutant emissions from mining, crushing, and construction activities within the Jerritt Canyon Project Expansion Area would primarily be total suspended particulates (TSP) and particulates of 10 microns diameter or smaller (PM_{10}). Minor emissions of sulfur dioxide (SO_2), oxides of nitrogen (NO_x), and carbon monoxide (CO) also result from these activities.

The mitigation measures (i.e., emissions controls, process rates, ore moisture, etc.) specified in the air quality permits required for these activities ensure that the pollutant emissions would be within acceptable limits and would not cause unacceptable impacts upon the air quality of the area. This means that there would be no exceedences of the State or National Ambient Air Quality Standards or of any PSD increment due to the mining activities. No mitigation measures beyond those required by the permits are proposed for any of the alternatives.

The only PSD Class I area within 60 miles (100 kilometers) of the study area is the Jarbidge Wilderness. The application of the mitigation measures previously discussed would ensure that no significant impact upon this Class I airshed would occur.

The existing air quality permits for the mine crushing and screening operations issued by NDEP may require modification with the implementation of an action alternative. These permits require monitoring and reporting of the moisture content of the ore being processed. This is intended to ensure that particulate emissions from the mine crushing and screening system would be properly controlled. No ambient monitoring would be required by NDEP. No additional monitoring requirements are proposed for any of the alternatives because past ambient monitoring indicated that the mining activities did not have a significant impact on ambient particulate concentrations. The surface disturbance permit (Permit to Control #3195) for the Jerritt Canyon Project was amended and approved by NDEP in 1992 to include the mine expansion area.

Alternative A - No Action

If the proposed action were denied, IMC anticipates that the existing operations at the Jerritt Canyon Project would be expected to continue at current levels until 1994, after which time the operations would begin to decline. Operations would cease sometime before or during 1996 (IMC, 1993a). The pollutant emissions due to the current mining activities would decrease and end as the mining operation declines and ends. After the end of mining and the completion of reclamation activities, air quality in the area would be expected to return to pre-mining conditions.

Alternative B - Proposed Action

The new mining and construction activities outlined in the proposed action would result in continued particulate and gaseous emissions. Particulate emissions would result from drilling, blasting, excavation, loading, hauling, dumping of waste rock and ore, and from crushing, handling, and storage of ore. Particulate emissions from mining consist mostly of large suspended particles that would settle out of the atmosphere very near the emissions source. Gaseous emissions would result from the operation of mining equipment and of generators. Gaseous pollutants and fine particles may be transported downwind before they settle out or are washed out by precipitation.

Changes in timing of runoff due to snowmelt increase from surface dusting has been expressed as an issue. Fugitive dust could be generated by pit blasting, loading, hauling on mine roads, and dumping. Some dust may be available to coat snowpacks in a downwind direction. The amount and distribution is uncertain, but probably would be very localized. Surface dusting of snowpacks can reduce albedo (reflectivity) and slightly increase melt rates under certain conditions. However, there is extreme variability in weather conditions, color, physical properties of windborne materials, and probable distribution. Dusting has very little effect when the minimum daily air temperature is below freezing (Colbeck 1988). New snow layers can bury any dust, thus keeping the snow albedo high. As the season nears spring, the snow albedo decreases, especially when the snow is wetted, and the melt rate increases naturally. Too high a rate of dusting can actually insulate snowpacks and retard melting.

The limited dust generated will be grayish in color rather than black. For the majority of time snow is present, the air temperatures are low, keeping melting due to dusting negligible. Periodic storms will increase albedos. For these reasons, any fugitive dusting on snow is not expected to be significant in increasing melt rates.

Air quality monitoring conducted upwind and downwind of the mill site on the east side of the range does not indicate an increase in airborne particulate matter when compared to background conditions. Based upon the results of this monitoring, it is reasonable to conclude that dust accumulation on the snowpack from blasting and traffic on roads is localized and has a negligible effect on the timing of surface runoff.

Alternatives C - G

The effects on air quality of Alternatives C through G are expected to be similar to those of Alternative B. There would be some minor variations in the locations of emissions sources and the amount of pollutants emitted, due to the differing locations and extent of the surface disturbances for each of the various alternatives. In particular, Alternative F probably would result in somewhat lower emissions than the other alternatives, because underground mining is the only mining method proposed for New Deep in that alternative. However, as noted above in the Section entitled "Effects Common to All Alternatives," the air quality permits issued under any alternative would require mitigation measures to

ensure that the permitted activities would not cause any substantial impact upon air quality.

Cumulative Effects

The cumulative effects on air quality in the study area would include elevated concentrations of TSP and PM_{10} particulates as mining and construction activities continue. Gaseous pollutants from operation of diesel-powered mining and construction equipment also would increase. Because of the air quality control measures, the cumulative effects of these activities on air quality in the study area are expected to be minimal. No irreversible and irretrievable commitment of air resources would result from the Proposed Action or alternatives. With cessation of mining and completion of reclamation activities, air quality would be expected to approach pre-mining conditions.

There are no other mining activities within 11 miles of the study area. Consequently, no measurable cumulative air quality impacts are expected due to mining activities outside of the study area.

Surface Water Resources

The Project Area is the area of direct and cumulative effects analysis for surface water. Indirect effects from changes in surface water flow may be experienced by downstream water users outside the Project area. Potential effects are considered over a time period coinciding with the life of the Project in the short term and in the long term after closure of all reasonably foreseeable mining and reclamation activities. Cumulative runoff and sediment yield calculations are based on final shapes of disturbed areas after completion of reclamation. The major water quality issues associated with the proposed action and the alternatives are: effects on surface water quantity, including discharge and timing of discharge and effects of disturbance on snow melt and deposition; effects to stream channel characteristics; effects to surface water quality due to potential acid rock drainage and sedimentation; and the potential for water to be impounded by pits. The capability of the waste rock under-dump drainage systems to transport sediment and runoff associated with storm events has also been raised as an issue by the USFS, and is discussed below with effects to stream channel characteristics. These items are discussed in the following sections.

Surface Water Quantity

Potential impacts to water quantity in terms of seasonal runoff were evaluated by the Simulator for Water Resources in Rural Basins (SWRRBWQ) computer model (Condor 1993). Pre-mining runoff was calculated, based on surface conditions prior to mining, in order to provide a baseline for analysis of cumulative effects and comparison among alternatives.

Seasonal runoff that would occur under the final post-reclamation configuration of the waste rock dumps for each alternative was calculated using precipitation, drainage basin

characteristics and runoff coefficients. Runoff calculations for this analysis consider all precipitation throughout the year, including snow, but did not include flow contributed by springs. Therefore, the estimated seasonal runoff volumes are likely lower than would be actually realized. Based on these calculations, the Alternative C reduction would be 890 acre-feet of water per year, which amounts to about two percent of the annual discharge at the Spanish Ranch USGS gage on the South Fork of the Owyhee River. Runoff calculations were performed for two locations within each basin. Calculated runoff volumes are summarized in Table 4.5.

Table 4.5
Change in Pre-Mining Condition Runoff by Alternative

	Runoff in acre feet in excess (+) or below (-) pre-mining condition			
Alternative	**JC-X[1]**	**JC-3[2]**	**BC-2[3]**	**BC-3[4]**
A	-90	-90	-520	-510
B	-490	-360	-520	-530
C	-490	-360	-520	-530
D	-440	-320	-520	-530
E	-560	-420	-520	-530
F	-10	-10	-520	-530
G	-490	-360	-520	-530

Source: Jerritt Canyon Mine Expansion Hydrology and Sedimentology Technical File Report, July 1993.

Note:
[1] Jerritt Creek Basin downstream of South Deep Dump sediment pond
[2] Jerritt Creek Basin at the border with the U.S. Forest Service (water quality measurement station JC-3)
[3] Burns Creek Basin downstream of Burns Basin Dump (water quality measurement station BC-2)
[4] Burns Creek Basin at the border with the U.S. Forest Service (water quality measurement station BC-3)

Although water quantity is expected to decrease as a result of the proposed mining operations, the timing of water flow would be somewhat regulated by the development of waste rock dumps. Waste rock dumps constructed in drainages within the Project area during the past 13 years of operation have been observed but not documented to absorb and slowly release water over an extended period of time later in the season. This phenomenon was observed below two existing waste rock dumps in the Snow Canyon drainage during the delineation of wetlands in August, 1992, after six consecutive years of drought (IME 1992). This phenomenon has not been observed in Burns Creek drainage.

Water is expected to infiltrate the proposed waste rock dumps more rapidly than the steep natural slopes, thereby reducing runoff volumes and evapotranspiration losses. Peak flows during flood events and spring snowmelt may be replaced by a more gradual release of water over a longer period of time than would occur in an undisturbed drainage.

The potential effects of the mining operations on snow deposition and snowmelt have been raised as an issue. Snowmelt does tend to occur more rapidly on the active haul roads as a result of heavy equipment traffic and snow removal operations. This is partially offset by the creation of snow piles that typically persist long after snow has melted from adjacent undisturbed areas. On inactive roads, snowmelt may occur earlier on the steeper cut and fill slopes. However, the safety berms constructed on these roads often cause snow drifts to form that typically melt more slowly than the snow on adjacent undisturbed ground. Dust produced by traffic on the roads during the winter and spring is typically minor, due to the high moisture contents within the road surface and base. The limited dust accumulation that does occur on the snowpack that results from blasting and road sanding is localized and is believed to have a negligible effect on the timing of runoff.

Alternative A

Under the No Action Alternative, existing operations would continue as analyzed and approved in previous NEPA documents and POOs. Compared to pre-mining conditions, existing operations would likely result in decreased water flow in Jerritt Creek as a result of interception of surface water flow by the existing pits in the headwaters of Jerritt Creek. Decreased flow may occur in Burns Creek after mining because the in-pit diversion would be breached and runoff allowed to drain into the pit.

Effects Common to All Action Alternatives

Jerritt Creek

The runoff calculations used to evaluate the effects on water quantity and the timing of discharge were based on the final configuration of the disturbed areas after reclamation under each alternative. Precipitation that falls within the pits and runoff that is captured by the pits would not contribute directly to downstream runoff and is the principal factor in the reduction of surface water runoff compared to pre-mining conditions. A limited amount of surface runoff would enter the Saval, Steer, and New Deep pits due to the location of these pits at or near the upper reaches of the watersheds. Most of the precipitation and runoff intercepted by the pits would recharge the local groundwater system by infiltration through the fractured rock in the bottom of the pits. This recharge may surface downstream of the pits as supplemental flow to streams, seeps and springs.

Compared to pre-mining conditions, impacts to surface water flow in Jerritt Creek at Station JC-X could vary from a loss of 10 acre feet under Alternative F to a potential loss of 560 acre feet under Alternative E. Alternatives B, C and G have the same potential impacts to runoff at approximately 490 acre feet below pre-mining conditions. Alternative

D would result in a loss of approximately 440 acre feet at the same location compared to pre-mining conditions. This may affect downstream users of the water.

Burns Creek

Effects to Burns Creek surface water flow do not vary between Alternative B through G. The direct effect of the action alternatives would be the reduction of runoff downstream of the pit by approximately 20 acre feet as a result of pit enlargement, compared to pre-mining conditions.

Over 95 percent of the cumulative impacts to runoff in Burns Creek are the result of the existing approved operations. At the completion of existing operations, the Burns Basin in-pit diversion ditch would be breached. The natural drainage upstream of the pit would be reestablished so that runoff enters the pit at the low point of the pit rim. Water entering the pit would be expected to evaporate or infiltrate into the fractured rock and karst system underneath the pit. Under the No Action Alternative, cumulative impacts could be an approximate loss of 520 acre feet at Point BC-2 and 510 acre feet at Point BC-3, compared to pre-mining conditions. Under the action alternatives, the cumulative impact could be a potential loss of approximately 520 acre feet at Point BC-2 and 530 acre feet at Point BC-3 compared to pre-mining conditions affecting downstream users.

Cumulative Effects

The cumulative effects to surface water quantity in Jerritt Creek and Burns Creek would be reduction in flow at the Forest boundary under current operations and all of the action alternatives. The greatest flow reduction in Jerritt Creek would occur under Alternative E and the least under Alternative F.

Stream Channel Characteristics

Stream channel characteristics would be modified by the construction of waste rock dumps in drainages and conveyance of stream flow through the base of the dumps. The capability of the waste rock under-dump drainage systems to transport sediment and runoff associated with storm events and effects to stream channel characteristics are discussed in the following section.

Alternative A - No Action

Under this alternative, no new disturbance would be approved and the existing operations would continue until completed. Existing operations have resulted in the disturbance of about 3.3 acres of ephemeral and intermittent stream channels. Diversion ditches have been developed in some areas to route surface runoff around disturbed areas such as the Winters Creek pit and the Burns Basin dump. Cross-valley waste rock dumps with under-dump drainage systems in Mill Creek and Burns Creek convey runoff and stream flow through these dumps.

Effects Common to All Action Alternatives

Jerritt Creek

All of the action alternatives would result in changes to stream channel characteristics. These changes would occur primarily in Jerritt, Saval and Steer Canyons, where 3.0 to 7.2 acres of stream channels would be excavated by pits or covered under the waste rock dumps by the under-dump drainage systems. Sediment control structures such as ponds and traps would also be constructed in various locations under each action alternative. Changes in Burns Creek would be primarily associated with pit enlargement, which would affect a few hundred additional feet of an ephemeral stream channel.

Effects to watersheds are sometimes evaluated in terms of the percentage of disturbance to the watershed for timber and range management programs. A summary of the percent of each watershed which has been or would be disturbed within the general study area is provided in Table 4.6.

Alternative B, C, D, E, and G

Under Alternatives B, C, D, E, and G, the South Deep waste rock dump would be developed in the Jerritt Canyon drainage. This dump would be constructed with a gravity-sorted under-dump drainage system capable of conveying flow underneath the dump. Rock sizes in the South Deep under-dump drainage system are expected to be larger than the rocks found in existing waste rock dumps due to the greater distance between blast holes and the increased bench heights in the New Deep pit. The under-drain would be constructed of material of which 50 percent would be 24 inches or larger.

Runoff would enter the South Deep under-dump drainage system via Jerritt Creek or its tributaries. Some runoff would be intercepted by pits. The height of the dump at the main inflow point in Jerritt Creek varies between the action alternatives. This could slightly affect inlet conveyance capacity, the magnitude of upstream ponding, and timing of flow.

Peripheral ditches would be developed along portions of the dump perimeter in order to collect runoff and convey it to the base of the dump or enhance infiltration. The peripheral ditches would be developed along the contact with natural topography.

The under-dump drainage system for the South Deep dump was analyzed for its capability to pass maximum flows from a 100 year event using the HEC-1 computer model developed by the Corps of Engineers (Condor 1993). The model used runoff coefficients (or CN values) for the various subbasins based on soil and cover types, dump inlet discharge capacity, frictional resistance to flow in the under-drain channel, and peak flows for the 100 year event. The analyses indicate that the under-drain would have a greater capacity than would be required to pass the flow that would result from a 100-year, 24-hour precipitation event. Peak flow at the dump exit was computed to be 366 cfs and the full capacity of the under-drain was computed to be a minimum of 2,060 cfs.

Table 4.6
Proposed & Cumulative Disturbance by Watershed (as percent of total watershed)

	Jerritt Creek	Burns Creek	Mill Creek	Snow Canyon
Alternative A				
Proposed	0%	0%	0%	0%
Cumulative	17.5%	12.5%	19.6%	3.1%
Alternative B				
Proposed	28.0%	7.1%	0%	0%
Cumulative	45.6%	19.5%	19.6%	3.1%
Alternative C				
Proposed	28.9%	7.8%	0%	0%
Cumulative	46.5%	20.3%	19.6%	3.1%
Alternative D				
Proposed	30.3%	7.2%	0%	0%
Cumulative	47.8%	19.6%	19.6%	3.1%
Alternative E				
Proposed	28.0%	7.0%	0%	0%
Cumulative	45.6%	19.5%	19.6%	3.1%
Alternative F				
Proposed	18.1%	7.7%	0%	0%
Cumulative	36.7%	20.2%	19.6%	3.1%
Alternative G				
Proposed	28.6%	7.1%	0%	0%
Cumulative	46.1%	19.5%	19.6%	3.1%

Source: USFS GIS Data Base.

Note: [1] Includes area of subsidence in Jerritt Creek watershed as a proposed disturbance.

The capability of the South Deep under-dump drainage system to pass the predicted sediment load in Jerritt Creek without clogging was also analyzed. The drainage system was determined to have an average flow velocity in excess of the minimum velocity required to keep silt and clay sediments in suspension. Overall, the under-drain void volume of 20,000,000 ft^3 is more than 650 times the average annual sediment yield of 30,000 ft^3 per year from the contributing watershed. This would indicate that most of the sediment would

pass through the under-drain, although some could settle out and be deposited locally in areas of lower velocity, most likely in the upstream portion of the drain and in back eddies within the underdrain.

Ongoing reclamation in the upper basin above the Jerritt Creek under-dump drainage system should reduce the amount of sediment delivered to the inlet of the South Deep dump.

Alternatives F and G

The proposed waste dump for Alternatives F and G, the underground mine alternatives, would be developed in the Jerritt Canyon drainage. This dump would be substantially smaller in volume and area than the dump for the open pit alternatives, but would still require a designed under-dump drain. There would be measurable standards for the coarseness and durability of the under-dump drain in the approved plan. The design of the under-dump drain would be based on the runoff from a 100 year precipitation event. The dump would be designed and constructed to pass the overflow and minimize erosion as much as practicable from an extreme precipitation event.

Burns Creek

Effects to drainage and stream channel morphology in Burns Creek as a result of pit expansion do not vary between action alternatives. Under Alternatives B and G, the expansion of the existing waste rock dump would impact a portion of the stream channel that flows into Burns Creek from the south. A portion of the diversion ditch around the existing waste rock dump would also be covered under these two alternatives.

Cumulative Effects

The cumulative effects to stream channels would increase from the current 3.3 acres to between 6.3 and 10.5 acres. The percentage of disturbance to the Jerritt Canyon and Burns Basin watersheds would also increase under each of the action alternatives.

Surface Water Quality

Concerns about water quality identified in Chapter 1 focus on two issues: 1) the potential for acid generation and resultant acid drainage from waste rock, ore stockpiles or pits and the introduction of these contaminants into waterways, and 2) potential increases in sedimentation resulting from roads, pits and waste rock dumps.

Acid Rock Drainage Potential

The potential for contaminants or acid leachate to be released from waste rock, ore stockpiles, or pits and introduced into surface waters was evaluated for the proposed project and is discussed under geochemistry in the geology sections of Chapters 3 and 4. The acid-base accounting analysis and kinetic test results indicate that there is a low potential for

acid rock drainage from waste rock derived from the Saval and Steer pits and expansion of the Burns Basin pit. The acid-base accounting analysis and kinetic test results for the New Deep waste rock indicate that there is a low to moderate potential for acid generation. Results of the static and kinetic testing were used to develop a waste rock evaluation program to guide additional sampling, handling and placement of materials that are determined to be acid-forming. With successful implementation of this program, the action alternatives would meet NDEP water quality standards. In the event that monitoring reveals a problem with acid generation or leaching of trace elements in the dumps, appropriate remedial action would be taken.

Sedimentation

Sediment yield is dependent upon soils, vegetation, topography, and climatic factors such as storm frequency, rainfall intensity, snow accumulation, and snowmelt. The sediment yield for the various alternatives was analyzed using the USDA's SWRRBWQ computer program. The major components of SWRRBWQ are surface runoff, percolation, return flow, evapotranspiration, transmission losses, sedimentation and plant growth (Condor 1993). Runoff volumes are predicted using the SCS curve number that is a function of soil moisture content, soils, and vegetation cover. Watershed dimensions, average slopes and slope lengths are also used in the model. Precipitation from Tuscarora, the nearest weather station, was corrected for elevation and temperature. Soil characteristics included in the program include the soil erodability parameter (K factor) and runoff parameter. The results of the analysis are shown in Table 4.7 as total annual sediment yield in tons. Sediment yield calculations were based on final configurations of disturbed areas after completion of reclamation.

The action alternatives would result in a short-term increase in sediment yield as a result of surface disturbance during pit development, haul road and waste rock dump construction. Until pits are deep enough to function as sediment traps, sedimentation would likely increase over existing conditions, but would be mitigated by construction of sediment control structures. Alternatives that have waste rock dump slopes at 2:1 or 3:1 would require regrading upon project completion that would not be required where angle of repose slopes are retained. Additional earth-moving required to create the flatter slopes could also increase the potential for sedimentation during the reclamation phase. Upon completion of reclamation, sediment yields would be reduced to below pre-mining conditions for all alternatives as described below for the Jerritt Creek and Burns Creek watersheds.

Jerritt Creek

Pre-mining conditions in Jerritt Creek indicate a sediment yield of about 3,970 tons at the proposed sediment pond and 4,520 tons at the USFS boundary. With the exception of Alternative A, all the alternatives would result in less sediment yield after final reclamation than the pre-mining condition. This would be primarily due to the presence of pits which would serve as sediment traps. Alternative A would have higher sediment yields

Table 4.7
Potential Change in Sediment Yield by Alternative

Alternative	Total Annual Sediment Yield in Metric Tons in excess (+) or below (-) pre-mining condition JC-X[1]	JC-3[2]	BC-2[3]	BC-3[4]
A	+400	+160	-260	-160
B	-1,040	-910	-260	-160
C	-1,040	-910	-200	-130
D	-730	-480	-200	-130
E	-1,000	-820	-200	-130
F	-50	-120	-200	-130
G	-1,040	-910	-260	-160

Source: Jerritt Canyon Mine Expansion Hydrology and Sedimentology Technical File Report, July 1993.

Note: [1] Jerritt Creek downstream of South Deep Dump sediment pond
[2] Jerritt Creek at the border with the U.S. Forest Service
[3] Burns Creek downstream of Burns Basin Dump (water quality measurement station BC-2)
[4] Burns Creek at the border with the U.S. Forest Service (water quality measurement station BC-3)

than the other alternatives primarily due to the smaller size of the existing pits relative to the disturbance associated with other mine facilities, primarily haul roads.

Burns Creek

Pre-mining conditions in Burns Creek indicate sediment yield of 1,100 tons at the sediment pond downstream of the dump and about 1,990 tons at the USFS border. Sediment yields after reclamation for all alternatives, including Alternative A, are less than for pre-mining conditions. This is primarily due to the fact that all water and associated sediment upstream of the pit drains to the pit.

Other potential impacts to water quality include impacts from accidental spills of petroleum products. In response to the risk associated with the transportation and storage of petroleum products, IMC has developed a SPCCP. All oil storage tanks are equipped with berms that serve as secondary containment and are of sufficient volume to contain the entire contents of the tank, plus precipitation events. The SPCCP addresses the need to minimize the potential for accidental spills and environmental contamination by discussing the steps that would be taken to contain and clean up such spills. Implementation of the SPCCP would significantly reduce the potential for accidental spills that may affect water quality.

Cumulative Effects

Under all action alternatives, a short-term increase in sediment yields may occur in the Jerritt Canyon watershed during the initial stages of mining. This would be mitigated by constructing sediment control structures. The cumulative effects to surface water quality due to sedimentation in Jerritt Creek and Burns Creek would be a reduction in the total annual sediment yields under all of the action alternatives after reclamation, when compared to Alternative A and baseline conditions. Potential cumulative effects to surface water quality due to generation of acid waters is discussed under geochemistry in the geology section of Chapter 4.

Groundwater Resources

The focus issue associated with groundwater resources is the potential for acid mine drainage to affect groundwater quality. Other issues associated with groundwater are the potential for groundwater to be impounded in the pits and potential effects to the flow of Niagara and Van Norman Springs. Effects to groundwater are discussed in terms of quantity and quality.

The Project area is the area of analysis for direct, indirect, and cumulative effects. Indirect effects analysis included an area of a three mile radius from the proposed New Deep pit. Cumulative changes are considered for past, present, and reasonably foreseeable mining.

Groundwater Quantity

The mine expansion operations would affect groundwater quantity by mining below the estimated water table in the New Deep pit; removing or covering springs and seeps in New Deep, Saval and Steer; and altering runoff, recharge, and discharge characteristics within disturbed areas. The anticipated magnitude and longevity of these impacts are discussed in the following sections.

Alternative A - No Action

There would be no impacts to groundwater quantity in the No Action Alternative other than those analyzed in previous NEPA documents.

Effects Common to Alternatives B, C, D, E, and G

The final elevation of the proposed New Deep pit bottom would be 5,960 feet, or approximately 140 feet below the estimated regional groundwater surface elevation in the New Deep mine area, as summarized in Table 4.8. The regional groundwater system is assumed to encompass the western slopes of the Independence Mountain Range from the drainage divide between Jerritt Canyon and Snow Canyon on the north to Burns Creek on the south and extending into the Independence Valley on the west. Mining in the New Deep

pit would occur below the estimated water table elevation of 6,100 feet for approximately the last three years of pit development, as presently planned, and groundwater would be expected to flow into the pit.

Table 4.8
Proposed Pit Bottom Elevations and Regional Groundwater Elevations

Pit	Pit Bottom Elevation After Expansion	Estimated Regional Groundwater Elevation
New Deep	5,960 feet	6,100 feet
Saval	6,560 feet	6,382 feet
Steer	7,280 feet	6,382 feet
Burns Basin	6,860 feet	6,500 feet

Source: Westec 1993.

Preliminary estimates of potential groundwater inflow rates for the New Deep pit range from 100 to 300 gpm (HCI 1993). These estimated rates of inflow are based on a transmissivity value of 1,000 gallons per day per foot obtained from airlift recovery tests of monitoring wells. This calculation assumed a storativity of 0.02, which is believed to be representative of water table conditions in fractured rock. The wide range of pit inflow values is due to the variability of groundwater flow characteristics which are expected in a fracture controlled, bedrock groundwater system such as occurs in the New Deep area. The extent to which water would collect in the pit during mining is not fully known, because this depends on the rate of water inflow and the extent to which the water evaporates or infiltrates into the fractured rock in the bottom of the pit. Water that would collect in this pit would be routed to in-pit sumps. If sufficient quantities are available and are of high enough quality, water would be stored in sumps, ponds or tanks and used for dust suppression or in other facets of the mining operations. The availability of water at New Deep would decrease the amount that is currently pumped over six miles to the mine site for use in mine operations and exploration drilling. Active dewatering of the New Deep pit area prior to mining is currently not anticipated. If active dewatering were necessary, the water would be routed to storage ponds or tanks and would be utilized for dust suppression or in other facets of mine operations. In the event that there was excess water beyond that required for the mining operations, IMC would obtain the required permits for surface discharge or underground injection.

Excavation of the New Deep pit would create a "cone of depression" (an area of lowered groundwater levels adjacent to the pit) during mining as a result of removal of water from the pit. The shape or radius of the cone of depression is not known, but it would likely be less than three miles from the deepest point in the pit, given the low

transmissivity of the rocks, numerous faults and fractures in the area and low flow rates expected. No water supply wells occur within a three miles radius of the pit, but developed and undeveloped springs in this area could potentially be affected, as discussed in the next section. Perched groundwater outside of the pit would not be affected, as the source of the perched groundwater is from precipitation, snow melt, and infiltrating surface water.

After mining is completed, groundwater may flow into the New Deep pit and stabilize at or near the pre-mining static water level of approximately 6,100 feet. Water impounded in the pit may reach a maximum depth of 140 feet and may have a surface area as large as 19 acres (HCI 1993).

Mining of the Saval and Steer pits and the expansion of the Burns Basin pit is not expected to intersect the regional groundwater table, but would intersect perched aquifers occurring at various elevations. Perched groundwater may flow into the pits but would be expected to either evaporate or infiltrate into fractured rock in the pit bottom, as has been observed in the past at the Jerritt Canyon mine. As a result, impoundment of groundwater in the Saval, Steer, and Burns Basin pits is not expected.

Alternative F

Direct effects to groundwater quantity for Alternative F would be less than the other action alternatives due to underground mining of the New Deep deposit. The New Deep underground mine would reach a maximum depth of 5,950 feet and inflow of regional groundwater would be expected to occur below approximately 6,100 feet. Sustained groundwater inflows into the New Deep underground workings were estimated to be 100 to 150 gpm (HydroGeo 1993). A maximum inflow of 250 gpm at any given time was predicted for the underground operations (HydroGeo 1993). Water utilized or encountered during underground mining would be directed to sumps located inside the underground workings and near the portal sites. Active dewatering prior to underground mining using wells and pumps is currently not anticipated. If active dewatering were necessary, the water would be routed to storage ponds or tanks and utilized for dust suppression or in other facets of the mining operations provided the water quality met state standards for dust control activities. In the event there was excess water beyond that required for the mining operations, IMC has obtained a permit from NDEP for underground injection of excess water and has applied for a permit to discharge to the surface.

The areal extent of the cone of depression that would form would be less than that for an open pit, due to the smaller size of the underground workings and because inflows to underground workings would be controlled using concrete, shotcrete, grout or other standard methods. Water would be impounded in the underground workings after mining but would not flow out of the portals to surface waters because the adits would be constructed as declines that intersect the surface (at elevations ranging from 6,460 to 6,800 feet) above the static groundwater level (at an approximate elevation of 6,100 feet).

Alternative G

Under Alternative G, both underground and surface mining of the New Deep orebody would occur. The effects to groundwater in the New Deep mine area would be a combination of those described for underground mining under Alternative F and those described for open pit mining under Alternatives B, C, D, and E. The cone of depression associated with this alternative may be slightly larger than that which would form under Alternatives B, C, D, and E, as the underground workings extend approximately 10 feet below the depth of the open pit proposed under those alternatives.

Effects to Springs and Seeps

Direct effects to as many as six springs and three seeps could occur as a result of physical disturbance due to covering of springs and seeps by waste rock dumps or from pit excavation. As many as two springs would potentially be indirectly affected by flow reduction due to excavation of the New Deep pit and depression of the water table in this area. The effects to springs and seeps under the action alternatives are summarized in Table 4.9. A short term reduction in spring flow could potentially occur at Niagara Spring and spring GDSP-25, both of which probably emanate from the regional groundwater aquifer and are within the estimated area of the cone of depression that could form. Effects to Niagara Spring are of particular concern as it is presently used as a source of irrigation water for a nearby ranching operation. No reduction in flow from Van Norman Spring is expected to occur as a result of mining the New Deep pit, because it is located nearly four miles away in a completely different watershed. This spring is located over two miles from the Saval/Steer mine area and Burns Basin pit expansion area. Since these pits are not expected to penetrate the regional groundwater table, flow reductions are not anticipated at Van Norman Spring.

Over the past ten years, flows from Niagara Spring have varied between 1,523 and 9,337 gpm, averaging 3,361 gpm. The degree of hydraulic connection between the New Deep pit area and Niagara Spring is not known due to complex faulting and poor exposure of the rock units in the area between the pit and Niagara Spring. Geologic data indicates that there are faults between the two sites that may act as flow barriers that would limit the hydraulic connection. If the New Deep pit and Niagara Spring were directly connected, the estimated inflows of 100 to 300 gpm represent only about three to eight percent of the average flow from this spring. Niagara Spring would continue to be monitored by IMC during implementation of any of the action alternatives. If a reduction of flow occurs that impairs the use of this spring and is attributable to mining, appropriate mitigation measures would be implemented. After mining, reduced spring flows would probably recover fully. Perched springs and seeps outside the pits and dumps would not be affected.

Indirect effects to other resources that result from reduction of flows and/or covering of springs and seeps may include reduced availability of water for wildlife and livestock, localized changes in vegetation, and waste rock dump stability issues related to foundation conditions. Reductions in water availability and vegetation changes outside of the proposed disturbance areas that may result from removing water from the New Deep pit would be

Table 4.9
Summary of Impacts to Springs and Seeps by Alternative

	Springs				SEEPS		
Alternative	Number Present in Area	Number Affected by Pits	Number Affected by Dumps	Number with Potential Effects to Flow[1]	Number Present in Area	Number Affected by Pits	Number Affected by Dumps
A	23	0	0	0	8	0	0
B	23	1	4	2	8	2	1
C	23	1	5	2	8	2	1
D	23	1	5	2	8	2	1
E	23	1	4	2	8	2	1
F	23	1	4	2	8	2	0
G	23	1	4	2	8	2	1

Note: [1] Potential effects to spring flow may occur if pit dewatering is required and a cone of depression in the water table is formed that has a three mile radius.

temporary in nature. Surface expression of springs that are covered by dumps would be relocated to the outlet of the under-dump drainage system. Waste rock dump stability would be enhanced as a result of maintaining the dumps in an unsaturated condition. This would be accomplished by allowing surface runoff and flows from springs and seeps located in the bottom of natural drainages to pass through the waste rock dumps. No springs or seeps on hillsides have been identified within the waste rock dump sites. If springs are discovered on hillsides and/or located within the waste rock dump sites, a trench drain would be developed that would allow flows to reach the under-dump drainage system or beyond the dump perimeter. Fine textured materials that may impede flows would not be placed in these areas.

Effects to Recharge and Discharge

Effects Common to all Action Alternatives

Excavation of pits above the water table could increase infiltration by capturing precipitation, temporarily ponding water, and enhancing recharge through the fractured bedrock in the bottom of the pits, during mining and after reclamation. If inflows are of sufficient quantity below the water table in the New Deep pit to require removal and use or discharge, then recharge to the groundwater system would be reduced during mining. Recharge would be expected to equal or exceed natural conditions after mining is completed. Mine dumps would enhance recharge to groundwater and decrease surface water runoff as a result of creation of relatively flat dump surfaces on steep natural terrain. Road

construction would increase runoff and decrease infiltration. The overall effect of the action alternatives would be to decrease runoff and slightly increase groundwater recharge during mining and after reclamation. These effects would be less for Alternative F than the other action alternatives because a pit would not be created in the New Deep mine area. Surface water runoff to other parts of the basin would decrease due to increased infiltration in the mine area.

Cumulative Effects

Existing mining operations have not encountered groundwater, other than minor seeps along pit highwalls that flow in response to snowmelt and precipitation. No future actions other than the proposed action or the action alternatives are foreseen for this groundwater system. Therefore, there are no past, present or future actions which would result in cumulative impacts to groundwater resources beyond those discussed for direct impacts.

Groundwater Quality

Alternative A - No Action

There would be no impacts to water quality under the No Action Alternative other than those resulting from actions analyzed in previous NEPA documents.

Effects Common to All Action Alternatives

Groundwater quality may be directly affected if generation of acid rock drainage and subsequent mobilization of trace metals and other compounds from waste rock and pits were to occur. The potential for acid rock drainage and trace metal mobilization to occur in the project area has been evaluated during geochemical waste rock characterization studies, described in detail in Chapter 3. Results of these analyses are discussed in the geochemistry section in Chapter 4.

Effects Common to Alternatives B, C, D, E, and G

If impoundment of water occurs in the New Deep pit, the potential also exists for changes in water quality as a result of interaction with rocks in the pit walls. Pit water would be expected to meet state water quality standards or baseline groundwater conditions. If the water does not meet state water quality standards, the water would be treated to meet state standards.

Spring and seep water quality may potentially be affected by contact with waste rock in areas where the springs and seeps have been covered by waste rock dumps, where dumps are located upstream, or by contact with pit walls following excavation of the pits. These waters would be impacted only if weathering of the waste rock by contact with the water and air generates poor water quality. The waste rock characterization and handling plan

to be implemented would ensure that potential acid-forming material is isolated from air and water or is otherwise handled so as not to degrade surface or groundwater resources.

Water that collects in the New Deep pit would be monitored on a regular basis after mining is completed. The monitoring program would be developed and incorporated into the final POO.

Effects Common to Alternatives F and G

If impoundment of water occurs in the underground mine workings, the potential also exists for changes in water quality as a result of interaction with rocks in the underground workings. The mine portals and other openings to the mine would be located approximately 300 to 500 feet above the estimated regional groundwater level. Water is not expected to flow out of any of the mine openings.

The potential for groundwater contamination to occur within the underground workings is low. The workings would be sealed when mining is completed, water inflows would be controlled with shotcrete or other methods, and portions of the underground workings would be backfilled. With implementation of these measures, degradation of groundwater is not expected.

Cumulative Effects

The proposed action, when combined with past and existing mining activities, would cumulatively increase the area which could be affected by weathering of pit wall rock, waste rock dumps, and ore stockpiles. The high TDS and sulfate concentrations recorded for springs GDSP-10 and MCDS-10 may indicate either groundwater in equilibrium with ore deposits or the oxidation of sulfides in adjacent and upgradient waste rock dumps. No baseline data were collected for these springs, and therefore the source of sulfate is unknown. Other than effects to groundwater that result from the proposed action and the action alternatives, no future actions are foreseen that would affect groundwater quality. Cumulative effects to groundwater resources would be a combination of the effects due to existing operations and proposed operations.

Wetlands

The potential for loss of wetlands was identified through public scoping as an issue. In order to provide a comprehensive evaluation of potential impacts to the proposed action and alternatives, the following analysis examines potential impacts to waters of the United States including wetlands. Mitigation is typically used to offset unavoidable adverse impacts which would occur after all appropriate and practical measures have been taken to minimize wetland impacts. The area of direct, indirect, and cumulative analysis is the Project area and areas of existing mining activity outside the Project area.

Alternative A - No Action

Under Alternative A, there would be no new impacts to existing waters or wetlands other than those already identified and authorized for existing and approved operations.

Effects Common to All Action Alternatives

There would be some direct and unavoidable disturbance to waters of the U.S. including wetlands under all of the action alternatives, as displayed in Table 4.10. Potential impacts to wetlands categorized according to habitat type are summarized in Table 4.11. Maps of potential impact areas for the proposed action have been submitted to the Corps and are included in Appendix C. Under any action alternative, affected wetlands would be less than a total of four acres. A finalized analysis of affected wetlands would be conducted by the Corps and be based on the ROD issued by the USFS for the FEIS. Wetland impacts associated with the alternative selected by the USFS would not be expected to exceed the range indicated in Table 4.10. Section 404 (b) (1) guidelines require that measures be taken to first avoid and second to minimize impacts to wetlands. The following sections summarize the avoidance, minimization, and mitigation strategies considered and incorporated into the alternatives.

Table 4.10
Summary of Impacts to Waters and Wetlands of the U.S. by Alternative

Description	Impacts (Acres)						
	Alternative A (Existing Approved Disturbance)	Alternative B	Alternative C	Alternative D	Alternative E	Alternative F	Alternative G
Waters	4.12	5.90	6.48	7.20	6.18	3.04	6.04
Wetlands	3.57	3.40	3.67	3.82	3.64	2.89	3.40
Total	**7.69**	**9.30**	**10.15**	**11.02**	**9.81**	**5.93**	**9.44**
Cumulative Total	7.69	16.99	17.84	18.71	17.50	13.62	17.13

Source: IMC August 1993.

Avoidance

As described in Chapter 2, various alternatives were considered by an IDT to address issues raised during scoping, including potential impacts to waters of the U.S. and wetlands. Mining pits were not subject to the alternatives analysis because pit locations and configurations are defined by the presence and depth of economic gold mineralization. As

Table 4.11
Impacts to Wetland Habitat Types by Alternative (Acres)

Alternative	Riparian Wetlands	Riparian Spring & Seep Wetlands	Isolated Spring & Seep Wetlands	Total Wetland Impact	Cumulative Wetland Impact
A	2.35	0.17	1.05	3.57	3.57
B	1.13	2.03	0.24	3.40	6.97
C	1.22	2.21	0.24	3.67	7.24
D	1.27	2.31	0.24	3.82	7.39
E	1.21	2.19	0.24	3.64	7.21
F	0.96	1.69	0.24	2.89	6.46
G	1.13	2.03	0.24	3.40	6.97

Source: IMC August 1993.

a result, impacts to waters and wetlands in the pits are considered unavoidable. Locations of waste rock dumps, haul roads, and sediment control structures were evaluated under several criteria such as stability factors. Sidehill type waste rock dumps were initially evaluated for the Saval, Steer, and New Deep mine areas as a means of avoiding waters and wetlands. This type of dump construction would not provide the required storage capacity and would fail to meet stability criteria. Due to these factors, alternatives incorporating sidehill type dumps that did not cross drainage bottoms were eliminated from further analysis, as described in Chapter 2. Haul road locations were selected to minimize the number of stream crossings and avoid wetlands to the extent possible. Sediment control measures would be installed in the drainage bottoms to maximize the effectiveness of these structures in intercepting runoff from fill related activities and to protect downstream waters and wetlands resources. The alternatives being examined in this DEIS result in unavoidable impacts to waters and wetlands that would be minimized as described in the next section.

Minimization

Guidelines in 40 CFR 230.10 (d) state that no discharge of dredged or fill material shall be permitted unless appropriate and practical steps have been taken to minimize potential adverse impacts of the discharge on the aquatic ecosystem. Minimization of impacts to waters and wetlands was incorporated into the design of Alternatives B, C, E, F, and G waste rock dumps. This was accomplished by designing the lower levels of the waste rock dumps under these alternatives as cross-valley fills with angle of repose slopes.

Developing the waste rock dumps in this manner utilizes the natural topography to maximize storage capacity and reduce the area of disturbance.

Several alternative dump sites at greater distances from the pits were evaluated as a means of minimizing impacts to waters and wetlands, as described in Chapter 2. The alternative dump site locations were eliminated from further consideration because of unfavorable haulage distances and the need to construct additional haul roads using deep fills across drainages. The stability of the road fills across the drainages was a factor considered by IMC in the development of their proposed action. Sediment traps, catchment basins, dumps, silt fences, hay bale check dams, and other effective methods would continue to be installed in appropriate locations before or during construction to intercept runoff and sediment from fill-related activities.

Mitigation and Monitoring

A mitigation and monitoring plan would be developed in coordination with appropriate resource agencies and a final plan would be approved by the Corps. The final mitigation plan would include, but not be limited to, the following: 1) identify the size and location of the mitigation area, 2) water sources to maintain the area, 3) revegetation plans, 4) a five year maintenance and monitoring plan including performance standards to determine mitigation success, 5) the parties ultimately responsible for the plan's success, and 6) contingency plans to be enacted if the plan fails.

IMC proposes to mitigate any unavoidable wetland losses by creation of new wetlands. IMC is currently implementing a wetland mitigation program designed to compensate for wetland impacts incurred from existing, approved operations.

Initially, the intent of this mitigation program was to create new wetlands as near as possible to the impacted areas. It became apparent, however, that there are several inherent disadvantages to this approach. In order to create new wetlands, a reliable water source is necessary. A reliable groundwater source is not available near the proposed areas of impact, so the mitigation would need to take advantage of available surface water. The problem with this is that areas with available surface water are, quite often, those with higher habitat values. It would be counterproductive to disturb areas with high existing habitat values to create wetlands. The greater total gain in habitat value would result from creating wetlands in areas with relatively low existing values.

Another disadvantage of creating wetlands as close as possible to the impacted area is that their proximity to existing mine operations and ore deposits could result in their being located in the path of future mine expansion. Mitigation should be designed so that the possibility for conflicts between mine operations and wetlands could be reduced, not increased.

Because of the above factors, the area for potential mitigation sites was extended. Eventually a site was located which had the potential not only for mitigating existing and approved impacts but also impacts which could result from future expansion such as the

proposed action and the alternatives examined in this FEIS. This mitigation area is located at the site of an old gravel pit at the eastern flanks of the Independence Mountain Range, approximately seven miles from the proposed disturbance area. The habitat has been altered by past borrow activities and although it is not currently a wetland, the groundwater is near enough to the surface that wetland hydrology conditions can be achieved by excavation. This conclusion is based on groundwater monitoring conducted in the spring and early summer 1993.

The mitigation area for existing and approved impacts is being constructed in a two-year, phased program. Initially, the land will be excavated to the approximate target elevations based on projected spring and early summer groundwater levels. The water level within the excavated area would then be monitored through one growing season. The contours would be adjusted as dictated by the monitoring and then application of top soil, seeding, and sprigging would be completed. The wetlands are being designed as a diverse aquatic system including riparian shrub, shallow water marsh, deep water marsh, aquatic bed, and upland nesting islands.

The area of wetlands being developed exceeds that required to mitigate previously incurred impacts. The wetlands being created could also compensate for impacts which would result from the proposed expansion. The ratio of wetlands created to wetlands impacted by the proposed action or alternatives would approach 2:1 regardless of the alternative selected. It is anticipated that full functional replacement of wetland values would be achieved under any alternative given the design factors of the mitigation area and the amount of wetlands created per acres impacted.

The excavation or filling of wetlands could indirectly impact wildlife as a result of habitat disturbance at a particular location. The proposed operations would not jeopardize continued existence of any TES species, or impact any identified cultural resources sites that are eligible for the National Register of Historic Places (NRHP). None of the alternatives are expected to significantly affect aquatic habitat or water quality. The reader is referred to the analysis for TES, cultural resources, aquatic resources, and water quality in Chapter 4 for more information.

Cumulative Effects

Cumulative impacts from existing approved operations and the proposed action alternatives are displayed in Table 4.10. Cumulative impacts are greatest under Alternative D and least under Alternative F.

4.3 Biological Environment

Aquatic Resources and Fisheries

The analysis areas for direct, indirect, and cumulative impacts for aquatic resources and fisheries are the same as the analysis areas for surface water. Potential effects are

considered over a time period coinciding with the life of the Project in the short term and in the long term after closure of all reasonably forseeable mining and reclamation activities. The issues associated with aquatic resources are primarily related to surface water and, to a lesser extent, groundwater. Related issues include effects to any threatened, endangered, sensitive, or candidate fish species.

Alternative A - No Action

There would be no impacts to aquatic resources under Alternative A other than those analyzed under previous NEPA documents. For Burns Creek previous mining and exploration activities have impacted 33% of the 8.4 miles of perennial/intermittent system of Burns Creek within National Forest System boundaries. Most of this disturbance is in the upper half of the system, above the section considered fishable.

Effects Common to All Action Alternatives

The effects of the action alternatives to surface water resources are discussed in detail in the surface water resources section of Chapter 4 of this FEIS. Surface water impacts that would directly affect aquatic resources include decreases in water quantity, timing of flow, and effects to water quality due to changes in sediment yields or generation of acid mine drainage.

Water quantity is expected to decrease below pre-mining levels as a result of the proposed mining operations as water is trapped in the pits. This decrease in water runoff volumes would be greater for the Jerritt Creek watershed because runoff in the Burns Basin watershed has already been affected by development of the Burns Basin pit. Burns Creek is the only stream known to have reproducing fish populations within the Project area. These decreases in water flow may negatively affect the aquatic resources present downstream of the mining operations. However, the timing of water flow would be somewhat regulated by the development of waste rock dumps. The projected decreases in stream flow may also be partially offset by increases in stream flow as water in the pits recharges springs located downstream from the mine area.

The action alternatives could result in a short-term increase in sediment yield as a result of surface disturbance during pit development and waste rock dump construction. Until pits are deep enough to function as sediment traps, sedimentation would likely increase over existing conditions, and would have a short term negative impact to water quality and aquatic resources. After reclamation and revegetation of the proposed mining activities, sediment yields are expected to be reduced to below pre-mining conditions for all alternatives in the Jerritt Creek and Burns Creek watersheds.

Additional disturbance to the perennial/intermittant stream channel of Burns Creek would occur under all action alternatives. Additional disturbance would range from 0.5 miles under Alternative E to 1.23 miles under Alternative G.

Vegetation

The issues associated with the vegetation resources of the project area include: 1) the potential for threatened, endangered, candidate, or sensitive plant species to be affected; 2) effects to vegetative diversity; and 3) the potential for aspen habitat to be fragmented. Related issues include effects to wildlife habitat, range resources and wetlands. The reclamation potential focus issue as it relates to vegetation is also discussed in this section. The analysis area for direct and indirect effects to vegetation is the Project area. The existing and proposed mine areas are the area of cumulative effects analysis for threatened, endangered, candidate, and sensitive species. Cumulative effects for other aspects of vegetation are analyzed within the context of the general study area.

Alternative A - No Action

Under Alternative A there would be no additional impacts to vegetation beyond those resulting from approved and existing operations. These effects have been analyzed in previous NEPA documents.

Threatened, Endangered, Candidate, and Sensitive Plant Species

As discussed in Chapter 3, no threatened or endangered plants or their habitat occur in the Project area. Potential habitat for three plant species classified as sensitive by the USFS occurs or may occur in the Project area. These three species are Lewis' buckwheat, meadow pussytoes, and Howell dimersia. These species were not found during intensive field surveys of the Project area and no negative effects are expected. Grimes vetchling is currently classified as a candidate species and has been petitioned for listing as an endangered species. Potential habitat for Grimes vetchling is not likely to occur in the Project area and this species was not found during Project area field surveys. Lieberg clover and Least phacelia, both candidate species, may occur within the Project area. While surveys have not been conducted specifically for these two species, none were observed during the TES plant surveys conducted within the Project area. The USFS plans to conduct surveys for these two species in 1994.

<u>Cumulative Effects</u>

For those species surveyed for during 1992 and 1993, no cumulative effects to threatened, endangered, candidate, or sensitive plant species are expected because no species were observed within the existing and proposed mine areas.

Vegetative Diversity

As discussed in the vegetation section of Chapter 3, there are 74 vegetation types in the Independence Mountains that have been grouped into ten community types. A summary of the effects of the project alternatives to these community types is presented in Table 4.12 and is discussed below.

Table 4.12
Vegetation Community Type Disturbed by Alternative
(Acres)

Vegetation Community Type	Alternative						
	A[1]	B	C	D	E	F	G
Sagebrush/Grasslands	0	1,555	1,620	1,608	1,472	919	1,593
Aspen							
Mature Aspen	0	623	648	641	627	613	623
Snowbank Aspen	0	14	14	15	14	14	14
North-Facing Mountain Brush	0	223	225	272	263	91	223
Sagebrush/Snowberry	0	90	100	145	130	89	98
Low Sagebrush/Grasslands	0	41	41	42	41	41	41
South-Facing Mountain Brush	0	<1	<1	<1	<1	0	<1
Herbaceous Meadow	0	9	10	16	9	10	9
Riparian	0	4	4	5	1	0	4
Snowbank Forb	0	0	0	0	0	0	0
Subalpine Fir/Pine	0	0	0	0	0	0	0
Total Additional Net Disturbance by Community (Acres)	**0**	**2,559**	**2,662**	**2,744**	**2,557**	**1,777**	**2,605**

Source: USFS GIS data base, June 24, 1993.

Note: [1]Under Alternative A, the No Action Alternative, there would be no new additional disturbance.

Direct effects to vegetative diversity would occur from disturbance to vegetative cover during development and operation of the proposed project or the action alternatives. Most of the disturbance would occur within the sagebrush/grassland community type, with lesser amounts of disturbance to the mature aspen and north-facing brush community types, both of which provide habitat for mule deer and other wildlife species. Alternative F would have the least impact (1,777 acres) to existing vegetation resources and Alternative D would have the greatest impact (2,744 acres) to existing vegetation resources.

All action alternatives would have direct and indirect effects on vegetative diversity in terms of abundance and distribution of vegetation. During the life of the Project, including reclamation activities, there would be a reduction in plant composition, age classes, heights, and canopy densities within disturbed areas. Once reclamation activities are completed and vegetation becomes re-established, new community types consisting of

a mixture of native and introduced grasses, forbs, and shrubs would develop. The reclaimed sites would contain early successional stages as a result of concurrent reclamation and would form a vegetation mosaic within the Project area in the short term. Over time, the first generation plantings of grasses, forbs, and shrubs would mature and reproduce and invasion by plant species from the adjacent undisturbed lands would occur. In the long term, the diversity of the vegetative cover in disturbed areas might be expected to be similar to adjacent upland habitat areas.

Cumulative Effects

The time frame for short term cumulative effects analysis is the life of the proposed Project plus the time required for establishment of vegetation on disturbed areas. This time frame from project initiation to establishment of vegetation is estimated to be between 14 and 16 years depending on the alternative chosen. Table 4.13 presents short term cumulative impacts in relation to pre-mining (baseline) vegetation for the Project area.

Table 4.14 presents short term cumulative impacts in relation to pre-mining (baseline) vegetation for the general study area. Assuming that the effects to vegetative diversity are directly related to the acreage disturbed, Alternative A, the No Action Alternative, would have the least short term cumulative impact to vegetative diversity within the general study area. Alternative D would have the largest short term cumulative impact to vegetative diversity within the general study area.

Tables 4.13 and 4.14 do not take into account reclamation efforts, but simply display amounts and types of existing vegetation that would be disturbed by existing and proposed activities, including exploration roads. Long term cumulative effects would result from unrevegetated disturbances, such as pit highwalls and armored angle of repose dump slopes. As presented in Table 2.2 in Chapter 2, cumulative long term disturbance would range from approximately 1,395 acres under Alternative F to 2,564 acres under Alternative G. This loss of vegetative cover represents a long term irreversible and irretrievable commitment of the resource.

Aspen Habitat Fragmentation

Attempts were made to analyze effects to aspen habitat fragmentation in terms of the distance between aspen stands and stand size. However, the GIS technology available was not adequate to perform the detailed spatial analysis required (Anderson, pers. comm., 1993). Effects to aspen habitat and fragmentation are therefore analyzed in terms of the acreage of direct removal, as shown in Table 4.12 and also the amount directly removed from third order watersheds as shown in Table 4.15.

The spatial distribution of mature and snowbank aspen community types relative to Alternative C is shown on Map 4.1. Most of the aspen communities that would be disturbed under any action alternative are located in the Saval and Steer mine areas, and all action alternatives have very similar disturbances in this area. Therefore, the amount of aspen disturbed does not vary substantively between action alternatives, and ranges from 627

Table 4.13
Short Term Cumulative Impacts to Vegetation Resources in the Project Area by Alternative

Vegetative Community	Baseline	Alternative						
		A	B	C	D	E	F	G
Sagebrush/Grassland	5,946.0	1,239.0	2,793.6	2,859.3	2,847.2	2,710.6	2,158.5	2,832.1
Aspen								
Mature Aspen	1,863.2	326.3	949.4	974.6	967.1	953.2	939.8	949.5
Snowbank Aspen	69.8	8.7	22.3	22.4	23.6	22.3	22.3	22.3
North-Facing Mountain Brush	1,540.8	210.6	433.7	435.9	482.6	474.1	301.7	433.7
Sagebrush/Snowberry	840.8	295.5	386.2	395.3	440.8	425.2	384.7	393.7
Low Sagebrush/Grassland	408.8	33.7	74.4	74.2	75.1	74.6	74.4	74.4
South-Facing Mountain Brush	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Herbaceous Meadow	36.7	2.7	11.9	12.3	18.8	11.9	12.3	11.9
Riparian	32.8	1.6	5.3	5.9	6.4	2.8	1.6	5.3
Snowbank Forb	11.6	1.4	1.4	1.4	1.4	1.4	1.4	1.4
Rock/Talus	91.1	12.0	12.0	12.0	12.0	12.0	12.0	12.0
TOTAL	10,841.7	2,131.7	4,690.4	4,793.3	4,875.0	4,688.1	3,908.6	4,736.4

Source: USFS GIS data base, June 24, 1993.

Note: Alternative impacts include 407 acres of existing USFS and exploration roads that are carried forward cumulatively across all alternatives.

Table 4.14
Short Term Cumulative Impacts to Vegetation Resources in the General Study Area by Alternative

Vegetation Community	Baseline	Alternative						
		A	B	C	D	E	F	G
Sagebrush/Grasslands	22,151	1,727	3,282	3,347	3,335	3,199	2,646	3,320
Aspen								
Mature Aspen	6,525	559	1,182	1,207	1,200	1,186	1,172	1,182
Snowbank Aspen	552	24	38	38	39	38	38	38
North-Facing Mountain Brush	3,169	257	480	482	529	520	348	480
Sagebrush/Snowberry	7,279	425	515	525	570	555	514	523
Low Sagebrush/Grasslands	3,354	102	143	143	144	143	143	143
South-Facing Mountain Brush	241	7	7	7	7	7	7	7
Herbaceous Meadow	45	4	13	14	20	13	14	13
Riparian	300	14	18	18	19	15	14	18
Snowbank Forb	45	2	2	2	2	2	2	2
Sub-Alpine Fir/Pine	6	0	0	0	0	0	0	0
Rock/Talus	305	16	16	16	16	16	16	16
USFS Administrative Area	82	0	0	0	0	0	0	0
TOTAL	**44,054[1]**	**3,137[1]**	**5,696[1]**	**5,799[1]**	**5,881[1]**	**5,694[1]**	**4,914[1]**	**5,742[1]**

Source: USFS GIS data base, June 24, 1993.

Note: [1]Includes 954 acres of existing USFS and exploration roads that is carried forward cumulatively across all alternatives.

acres under Alternative F to 662 acres under Alternative C (Table 4.12). Projected estimated disturbance of existing aspen in the Project area would range from 39 percent under Alternative F to 42 percent under Alternative C. Disturbance in the Jerritt Canyon watershed would range from 541 acres (53 percent) under Alternative F to 597 acres (65 percent) under Alternative D. Disturbance in the Burns Creek watershed would range from 140 acres (10 percent) under Alternative E to 162 acres (13 percent) under Alternative C. For the general study area, the projected disturbance would range from approximately 9.6 percent under Alternative F to 10.1 percent under Alternative C.

Several large contiguous aspen stands that occur on north-facing slopes in Saval and Steer Canyons would be disturbed under all action alternatives. Small isolated islands of aspen habitat would remain after project implementation, and these islands may be selectively utilized by some plant and animal species.

Table 4.15 Direct Removal of Aspen Disturbance by Alternative (in Acres)							
	Baseline	Alternative					
		B	C	D	E	F	G
Aspen in Jerritt Watershed							
Mature Aspen	879	571	572	593	582	542	571
Snowbank Aspen	48	16	16	17	16	16	16
Aspen in Burns Watershed							
Mature Aspen	1,352	171	190	161	158	176	171
Snowbank Aspen	31	< 1	< 1	< 1	< 1	< 1	< 1

Source: USFS Database, February 17, 1994.

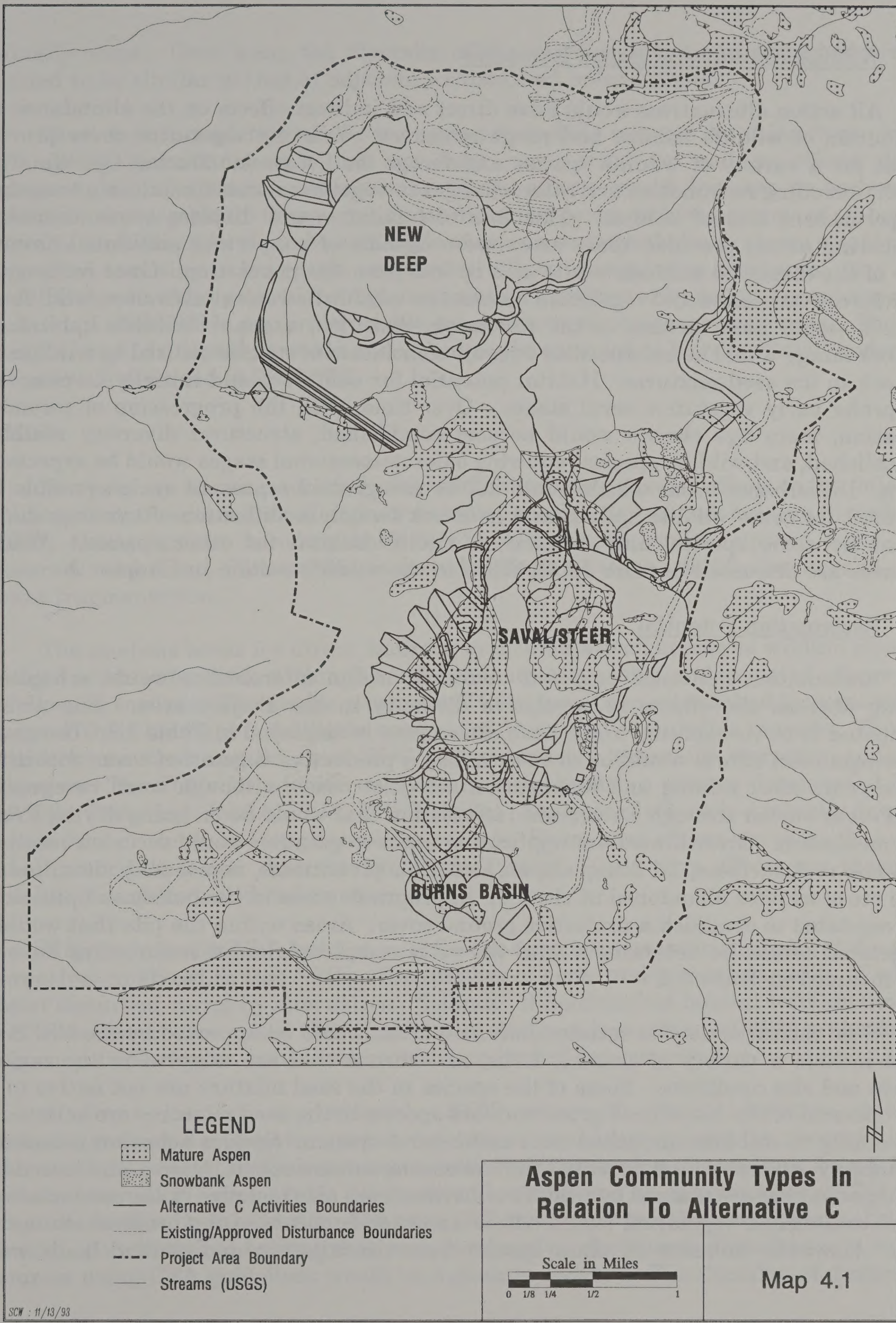
Cumulative Effects

Cumulative effects to aspen habitat fragmentation are summarized in Table 4.14. As discussed above, differences in the magnitude of cumulative effects between the action alternatives are minimal due to the location of aspen stands relative to proposed disturbance in the Saval and Steer mine area. The cumulative loss of aspen is a long term effect that, for all practical purposes, would be both an irretrievable and irreversible commitment of the aspen resource. The off-site mitigation measures for aspen replacement listed in Chapter 2 would partially mitigate the cumulative effects.

Other Issues Related to Vegetation

Wetlands

There would be some unavoidable disturbance to wetlands that are included within the riparian and herbaceous meadow community types under all action alternatives. Wetlands are not distinguished as a community type under the ECODATA mapping system. The wetlands in the Project area were delineated and approved in accordance with Corps guidelines. Effects to wetlands would be avoided or minimized to the extent practicable. Unavoidable effects would be mitigated through the enhancement and/or creation of wetlands, as discussed under the Wetlands section of Chapter 4.


NEW
DEEP
SAVAL/STEER
BURNS BASIN
LEGEND
Mature Aspen
Snowbank Aspen
Alternative C Activities Boundaries
Existing/Approved Disturbance Boundaries
Project Area Boundary
Streams (USGS)
SCW : 11/13/93
Aspen Community Types In Relation To Alternative C
Scale in Miles
0 1/8 1/4 1/2 1
Map 4.1

Wildlife Habitat and Range Resources

All action alternatives would have direct and indirect effects on the abundance and distribution of wildlife habitat and range resources. Existing vegetative cover provides habitat for a variety of wildlife species and forage for livestock. During the life of the Project, including reclamation activities, changes in vegetation would result in a temporary and permanent loss of habitat. This loss of habitat would displace some animals to neighboring areas, provided those areas were capable of supporting additional animals. Some of the displaced animals would also be lost from the population. Once reclamation activities are completed and vegetation becomes re-established on suitable sites, wildlife and livestock would likely return to the previously disturbed areas. Wildlife habitat and livestock forage would be enhanced as a result of inclusion of species utilized by wildlife and livestock in the seed mixtures. Habitat potential for wildlife would initially favor species that prefer early vegetative seral stages. Over time, with the progression of secondary succession, more age classes would become established, structural diversity would be reestablished, and wildlife species requiring older successional stages would be expected to return. Disturbance areas which would not be revegetated represent an irreversible loss of habitat for some wildlife species and livestock forage, modification of existing wildlife habitat for some species, and creation of wildlife habitat for other species. Wildlife resources are discussed in more detail below in the wildlife section in Chapter 4.

Reclamation Potential

Reclamation activities proposed under all action alternatives would mitigate to varying degrees the effects to vegetative diversity in the Project area. The acreage anticipated to be revegetated under each alternative is displayed in Table 2.2. The goal of the revegetation efforts would be to re-establish a productive vegetation cover within two to five years after mining and reclamation activities cease, although some revegetation would occur earlier through concurrent reclamation that would be on-going during Project implementation. Growth medium application and revegetation would occur on relatively flat waste rock surfaces, 3:1 dump slopes, accessible pit bottoms, new facility sites, and low grade ore stockpiles abandoned at closure. Appropriate areas in the bottoms of pits would be revegetated to establish a protective ground cover. Areas within the pits that would be revegetated cannot be determined until the pit is completed, and therefore they have not been included in Table 2.2.

Seed mixtures used to reclaim disturbed areas would be approved by the USFS and would include a variety of grasses, forbs, and shrubs that are adapted to the regional climate and site conditions. Some of the species in the seed mixture are not native to the area. Several of the introduced grass and forb species in the seed mixtures are selected for their ability to stabilize disturbed sites and control erosion. Species selection is based on adaptability, diversity, and potential for succession enhancement. Native and introduced plant species that are utilized by wildlife or livestock are also included in the seed mixtures. The re-established vegetation would not be an exact duplicate of the original community types. However, invasion by plant species from the adjacent undisturbed lands would

gradually occur. Over time, the diversity of the vegetative cover in disturbed areas is expected to be similar to that of adjacent undisturbed upland areas.

Short term cumulative effects to vegetation include impacts resulting from existing and ongoing disturbance that has not been revegetated as well as effects due to implementation of an action alternative. These effects would decrease as reclamation activities and revegetation take place. Some disturbed areas such as portions of pit bottoms and walls, portions of haul roads, and angle of repose waste rock dump slopes would not be revegetated resulting in long term cumulative effects to vegetation resources. Any areas that do not become revegetated through reclamation activities or by natural processes would result in an irreversible and irretrievable commitment of vegetation resources. The total acreage of disturbances that would and would not be expected to be revegetated under each alternative is provided in Table 2.2.

Wildlife

The primary issues associated with wildlife include potential effects to the following: 1) endangered, threatened, candidate, or sensitive species, 2) goshawk habitat, 3) mule deer habitat, 4) sage grouse brooding habitat, 5) golden eagles, and 6) upland game birds, furbearers, and trout. Related issues include effects to other wildlife species and aspen habitat fragmentation.

The analysis areas for direct, indirect, and cumulative impacts to wildlife resources are third order watersheds within the Independence Mountains, unless noted otherwise in the following sections. Thresholds of concern (TOCs) have been established for some wildlife species or their habitats to facilitate analysis of direct and cumulative impacts. The level of disturbance that results in a TOC being exceeded generally warrants additional mitigation. The TOCs for wildlife were determined through a process documented in the draft CEA Technical Guide (USDA, USFS 1992a). Analysis of effects is generally described in terms of short-term and long-term time periods. Short-term effects are those that would generally not last longer than the life of the Project. Long-term effects are those that continue after closure and reclamation.

A direct loss of wildlife habitat would occur upon implementation of any of the action alternatives analyzed in this FEIS. The number of acres and potential quality of wildlife habitat disturbed varies by alternative. "Islands" of undisturbed habitat were analyzed as short term disturbance under CEA guidelines. Indirect impacts to wildlife in the form of temporary displacement would also result from project implementation.

A direct loss of approximately 2,559 acres of wildlife habitat, primarily sagebrush/grassland and mature aspen vegetation, would occur under the proposed action (Alternative B). Direct disturbance varies with the other action alternatives from a low of approximately 1,777 acres under Alternative F to as much as approximately 2,744 acres under Alternative D. In addition, 344 acres (Alternative F) to 419 acres (Alternative D) of "islands" of undisturbed habitat that were analyzed as short term disturbance to wildlife resources using CEA guidelines would be indirectly affected. The duration of disturbance

is determined by the type of disturbance. For example, relatively flat dump surfaces are considered short term disturbance and pits, haul roads, and angle of repose slopes are considered long term disturbance.

Direct, indirect, and cumulative effects vary according to the particular wildlife related issue being considered. For this reason, each of the wildlife issues are discussed separately.

Alternative A - No Action

There would be no direct, indirect, or cumulative impacts to wildlife resources under the No Action Alternative other than those that may result from existing and approved operations. These impacts have been analyzed in previous NEPA documents.

Endangered, Threatened, Candidate, and Sensitive Species

Field surveys conducted by JBR in 1992 and WESTEC biologists in 1993 determined the extent of endangered, threatened, candidate, and sensitive animal species occurring or potentially occurring in the Project area. These surveys, combined with information obtained from a literature review and previous surveys, were used to analyze potential impacts to endangered, threatened, candidate, and sensitive species.

Endangered Species

Impacts to bald eagles, which may occasionally migrate through the Project area annually, and peregrine falcons that may rarely pass through the area would be negligible. Neither of these species would be affected by loss of habitat or altered distribution of forage under any of the action alternatives.

Threatened Species

There are not likely to be any additional impacts to Lahontan cutthroat trout as a result of any action alternative. Prolonged use of the haul road that was analyzed in previous documents would occur under all action alternatives. Potential impacts to Lahontan cutthroat trout under the no action alternative have been analyzed in previous NEPA documents, including the FEIS for the original Jerritt Canyon Project and subsequent EAs and POO modifications.

Candidate Species

Potential habitat for the Preble's shrew, pygmy rabbit, western big-eared bat, and spotted bat exists within the Project area, but none of these mammals were observed during the field surveys for the mine expansion. Because of the widespread distribution of these species, no significant impacts are expected for any of these species or their habitats as a result of project implementation. The two bat species rely heavily on water sources for both watering and food, but mist net surveys of the only two ponds within the Project area that

contained water in 1992 did not reveal the presence of either species. Since none of the ponds within the Project area would be eliminated as a result of implementation of any action alternative, there would be no adverse impact to these ponds as potential bat habitat. Existing roosting habitat may be disturbed or displaced under any action alternative, but some habitat may also be created as a result of mining. Spotted bat habitat may be created by the exposure of pit walls having cracks and crevices that would serve as potential spotted bat roosting sites. Current highwalls in the Jerritt area do not appear to have cracks suitable for roosting habitat (Warder, pers. comm.). Mine shafts and adits created by underground mining, as proposed in Alternatives F and G, could possibly create western big-eared bat roosting habitat depending upon the final closure methods utilized.

Sierra Nevada red fox and lynx were not observed during field surveys of the Project area. As described in Chapter 3, these species are not expected to occur in the Independence Mountains or the Project area. No adverse impacts on these two species are expected to result from the mine expansion operations.

Of the two Category 2 bird species described in Chapter 3 under Candidate Species that have the potential to occur within the Project area, only habitat for the loggerhead shrike exists. Neither of the two candidate bird species was observed in the Project area during the field surveys for the mine expansion. Loggerhead shrikes have been observed at lower elevations near the Project area. Because of the widespread distribution of loggerhead shrikes and the fact that the Category 2 listing is primarily the result of concerns for this species in the eastern U.S., this species is not expected to be adversely affected by any of the action alternatives.

Redband trout is the only Category 2 fish species that has the potential to occur in the vicinity of the Project area. NDOW has identified Burns Creek as potential habitat for this species. The trout species in Burns Creek has not been genetically tested, but NDOW considers them redband trout. Burns Creek changes from ephemeral to intermittent below the existing mining operations until it is within about one mile of the western Forest boundary, where perennial flows may be encountered. Sediment yields and flows in the long-term are expected to decrease in Burns Creek due to the pit expansion, as discussed in the surface water resources section of Chapter 4. Decreased flows and short-term increases in sedimentation could have some adverse effects, but in the long-term this may be partially offset by the potential for more gradual release of water from the waste rock dumps, and reductions in peak flows from flood events, which may reduce sediment flows that occur during high runoff periods.

Spotted frogs have the potential to occur within the Project area. Although potential habitat exists for this species, no spotted frogs were observed during the 1992 and 1993 field surveys of the Project area. Although riparian habitat would be lost, the spotted frog is not expected to be adversely affected by any of the action alternatives.

Although Mattoni's blue butterfly has the potential to occur within the Project area, no Mattoni's butterflies were observed during the 1992 and 1993 field surveys. The

presence of this species in the Project area is considered unlikely and no impacts would be expected under any action alternatives.

Sensitive Species

The flammulated owl is the only USFS sensitive animal species that is not also classified as Category 2 or an MIS that has the potential to occur within the Project area. Habitat for this species is likely present within the Project area, but no flammulated owls were observed during the field surveys. Potential flammulated owl habitat within the Project area would be reduced by implementation of any of the action alternatives. Proposed removal of mature aspen varies from approximately 614 acres in Alternative F to 648 acres in Alternative C. Though reclamation activities may re-establish some aspen, tree size would be too small for nest cavities for several decades. Consequently, long term loss of potential flammulated owl habitat exists under all action alternatives.

Cumulative Effects

With the exception of northern goshawk and flammulated owl habitats, the existing mining operations have not impacted any endangered, threatened, candidate, or sensitive species. Therefore, the cumulative effects would be the same as those described for direct effects.

Management Indicator Species

Northern goshawk, mule deer, sage grouse, and trout have been identified as management indicator species (MIS) for the Humboldt National Forest. Direct, indirect and cumulative effects are presented for each species in the following sections.

Northern Goshawk

Northern goshawk are present within the Project area between March and October of each year. The goshawk is considered to be an indicator of the condition and trend of old growth cottonwood-aspen stands that occur in riparian areas.

The CEA technical guide has established TOCs for goshawks based on disturbance within the 1.75 mile radius that defines the home range for each nest site. The short and long term TOCs are direct removal of 20 and 10 percent, respectively, of the home range. Results of CEA analysis for the home ranges that would be affected by the action alternatives are presented in Tables 4.16 through 4.23.

Goshawk nests have been grouped into nesting territories by the USFS. Goshawk nests within the same nesting territory are considered to be alternate nests, with only one of the nests being used during a particular year. This analysis considers effects to home ranges grouped according to the nests that are within a particular nesting territory.

Table 4.16 Impacts to Goshawk Home Range Habitat Nest 027						
		Cumulative Impacts				
		Short Term[1]		Long Term		
Alternative	Direct (Acres)	(Acres)	(%)	(Acres)	(%)
A	0	426.7	7.0	173.4	2.8
B	296.0	722.7	11.8	425.4	6.9
C	316.5	743.2	12.1	432.3	7.1
D	301.3	728.0	11.9	420.3	6.9
E	296.0	722.7	11.8	425.4	6.9
F	315.3	742.0	12.1	436.3	7.1
G	296.0	722.7	11.8	425.4	6.9

Note: [1] Short term cumulative impacts include long term cumulative impact averages.

Table 4.17 Impacts to Goshawk Home Range Habitat Nest 037					
		Cumulative Impacts			
		Short Term[1]		Long Term	
Alternative	Direct (Acres)	(Acres)	(%)	(Acres)	(%)
A	0	390.1	6.4	191.6	3.1
B	0.1	390.2	6.4	191.7	3.1
C	0.1	390.2	6.4	191.7	3.1
D	0.1	390.2	6.4	191.7	3.1
E	0.1	390.2	6.4	191.7	3.1
F	0.1	390.2	6.4	191.7	3.1
G	0.1	390.2	6.4	191.7	3.1

Note: [1] Short term cumulative impacts include long term cumulative impact averages.

Table 4.18 Impacts to Goshawk Home Range Habitat Nest 074					
		Cumulative Impacts			
		Short Term[1]		Long Term	
Alternative	Direct (Acres)	(Acres)	(%)	(Acres)	(%)
A	0	762.9	12.5	302.3	4.9
B	1,813.6	2,576.5	42.1	1,330.6	21.7
C	1,889.6	2,652.5	43.3	1,320.1	21.6
D	2,010.5	2,773.4	45.3	1,186.8	19.4
E	1,969.0	2,731.9	44.6	1,208.0	19.7
F	1,665.5	2,428.4	39.7	1,355.6	22.1
G	1,813.6	2,576.5	42.1	1,330.6	21.7

Note: [1] Short term cumulative impacts include long term cumulative impact averages.

Table 4.19 Impacts to Goshawk Home Range Habitat Nest 127					
		Cumulative Impacts			
		Short Term[1]		Long Term	
Alternative	Direct (Acres)	(Acres)	(%)	(Acres)	(%)
A	0	804.4	13.1	281.8	4.6
B	2,618.6	3,423.6	55.9	1,787.2	29.2
C	2,679.1	2,483.5	56.9	1,773.6	29.0
D	2,771.2	3,575.6	58.4	1,629.9	26.6
E	2,605.9	3,410.3	55.7	1,617.1	26.4
F	1,848.1	3,652.5	43.3	1,341.8	21.9
G	2,648.5	3,452.9	56.4	1,816.2	29.7

Note: [1] Short term cumulative impacts include long term cumulative impact averages.

Table 4.20
Impacts to Goshawk Home Range Habitat
Nest 128

Alternative	Direct (Acres)	Cumulative Impacts			
		Short Term[1]		Long Term	
		(Acres)	(%)	(Acres)	(%)
A	0	987.7	16.1	394.4	6.4
B	2,548.5	3,536.2	57.7	1,836.5	30.0
C	2,608.4	3,596.1	58.7	1,817.9	29.7
D	2,731.6	3,719.3	60.7	1,673.2	27.3
E	2,535.8	3,523.5	57.5	1,660.1	27.1
F	1,743.8	2,731.5	44.6	1,381.3	22.6
G	2,588.2	3,575.9	58.4	1,870.4	30.5

Note: [1] Short term cumulative impacts include long term cumulative impact averages.

Table 4.21
Impacts to Goshawk Home Range Habitat
Nest 134

Alternative	Direct (Acres)	Cumulative Impacts			
		Short Term[1]		Long Term	
		(Acres)	(%)	(Acres)	(%)
A	0	669.1	10.9	315.1	5.1
B	520.7	1,189.8	19.4	722.2	11.8
C	551.7	1,220.8	19.9	723.8	11.8
D	524.3	1,193.4	19.5	706.5	11.5
E	519.0	1,188.1	19.4	711.6	11.6
F	545.4	1,214.5	19.8	740.1	12.1
G	520.7	1,189.8	19.4	722.2	11.8

Note: [1] Short term cumulative impacts include long term cumulative impact averages.

Table 4.22
Impacts to Goshawk Home Range Habitat
Nest 135

Alternative	Direct (Acres)	Cumulative Impacts			
		Short Term[1]		Long Term	
		(Acres)	(%)	(Acres)	(%)
A	0	718.5	11.7	358.0	5.8
B	442.5	1,161.0	19.0	673.4	11.0
C	473.5	1,192.0	19.5	675.0	11.0
D	446.1	1,164.6	19.0	659.5	10.8
E	440.8	1,159.3	18.9	664.6	10.8
F	467.2	1,185.7	19.4	691.4	11.3
G	442.5	1,161.0	19.0	673.4	11.0

Note: [1] Short term cumulative impacts include long term cumulative impact averages.

Table 4.23
Impacts to Goshawk Home Range Habitat
Nest 136

Alternative	Direct (Acres)	Cumulative Impacts			
		Short Term[1]		Long Term	
		(Acres)	(%)	(Acres)	(%)
A	0	728.4	11.9	374.5	6.1
B	335.4	1,063.8	17.4	597.9	9.8
C	366.4	1,094.8	17.9	599.4	9.8
D	339.0	1,067.4	17.4	587.2	9.6
E	333.7	1,062.1	17.3	592.3	9.7
F	360.1	1,088.5	17.8	615.8	10.1
G	335.4	1,063.8	17.4	597.9	9.8

Note: [1] Short term cumulative impacts include long term cumulative impact averages.

The three historic goshawk nests (074, 127, and 128) that occur within the Project area would be disturbed by all action alternatives. These three nests represent one nesting territory. Sometime during the early 1980's this nesting territory was apparently

abandoned by a breeding pair. Nest 074 would be removed by the Steer pit and nests 127 and 128 would be covered by the South Deep waste rock dump. The cumulative short and long term TOCs would be exceeded for all three of these historic goshawk nests, but portions of the home ranges would be undisturbed. Due to the loss of habitat and continued disturbance it is expected, that this nesting territory would remain unsuitable for goshawk nesting during the life of this Project. It is possible that this nesting territory would become active after mining and reclamation activities within the Jerritt Canyon area are completed. The disturbance to this nesting territory would not affect the species as a whole.

Goshawk nests 134, 135, and 136 are located in the same nesting territory near the Burns Basin Mine area. Nest 134 is within about 300 feet of the Burns Basin pit. Both of these nests have been occupied in recent years. Nest 134 was active in 1991 and produced three young. Nest 136 was occupied and produced three young in 1992, and two young in 1993 (Younk pers. comm. 1993). New home range disturbance does not differ significantly between alternatives for these three nests. Direct disturbance to nest 134 home range would range from 519 acres (8 percent) under Alternative E to 552 acres (9 percent) under Alternative C. Direct disturbance to nest 135 home range would range from 443 (7 percent) acres under Alternative B to 467 (7 percent) under Alternative F. Direct disturbance to nest 136 home range would vary from 334 acres (5 percent) under Alternative E to 366 acres (6 percent) under Alternative C. The short and long term TOCs for each nest are displayed in the corresponding tables.

Goshawk nests 027 and 037 are outside of the Project area and in separate nesting territories. The home ranges for these two nests extend into the Project area. Additional home range disturbance would occur to both nests under any action alternative. Disturbance to nest 027 home range would vary from 296 acres (5 percent) under Alternatives B, E, and G to 316 acres (5 percent) under Alternative C. Disturbance to nest 037 home range would be 0.1 acre under all action alternatives. The short and long term TOCs would not be exceeded for either nest under any of the action alternatives.

Nests 025, 026, 031, 039, and 143 are not in the Project area. The home ranges for these nests extend into the Project area, but no new disturbance would occur within the home ranges for these five nests under any of the action alternatives.

The occupancy data for goshawk nests 134 and 136 indicate that the established TOCs for goshawk based on direct removal of home range acreage does not adequately evaluate actual impacts to goshawks. The relative effects of the project alternatives on goshawks can also be determined by the proximity, timing, and duration of activity in relation to post-fledgling areas (PFAs) (USDA, USFS 1993a). PFAs are delineated to include 600 acres of mature aspen habitat around nest sites. A small portion of the Burns Basin PFA would be affected by expansion of the existing waste rock dump under Alternatives B and G. Expansion of the Burns Basin waste rock dump into this PFA would not reduce the current 300 foot distance between Nest 134 and proposed disturbance.

Mule Deer

Direct and cumulative impacts to mule deer habitat were analyzed in relation to winter and summer range, as well as fawning habitat. The province for mule deer analyzed in this document varies with the type of range or habitat.

Winter Range

The province for mule deer winter range is defined in the CEA technical guide as the area utilized by the Management Area 6 deer herd in the winter on USFS lands in the Independence Mountains. That area of high and moderate RVR encompasses approximately 16,204 acres. Direct impacts on high to moderate value mule deer winter range would vary from a low of approximately 1,790 acres (11 percent) under Alternative F to a high of approximately 2,854 acres (17.6 percent) under Alternative D.

Cumulative short term impacts, including "islands" of undisturbed habitat, on high to moderate RVR lands of this habitat type would vary from approximately 3,623 acres (22.4 percent) under Alternative F to 4,687 acres (28.9 percent) under Alternative D. Long term cumulative impacts would be approximately 1,857 acres (11.5 percent) under Alternative F to 2,346 acres (14.5 percent) under Alternative G, as shown in Table 4.24.

Table 4.24
Impacts to Mule Deer Winter Range

Alternative	Direct (Acres)	Cumulative Impacts			
		Short Term[1]		Long Term	
		(Acres)	(%)	(Acres)	(%)
A	0	1,833	11.3	846	5.2
B	2,627	4,459	27.5	2,312	14.3
C	2,698	4,530	28.0	2,303	14.2
D	2,854	4,687	28.9	2,156	13.3
E	2,618	4,451	27.5	2,132	13.2
F	1,790	3,623	22.4	1,857	11.5
G	2,666	4,499	27.8	2,346	14.5

Note: [1] Short term cumulative impacts include long term cumulative impact averages and "islands" of undisturbed habitat. Province for mule deer winter range used for this analysis is approximately 16,204 acres in size, the area of high and moderate RVR value winter range in the Independence Mountain Range.

Aspect and slope are the topographic features within the Jerritt Canyon area that provide components for suitable winter range. In areas with the right conditions of aspect and slope, snow is melted, the vegetation is available and the warmer temperatures provide resting sites for mule deer. Reclaimed slopes that are not revegetated (due to armoring with coarse and durable rock) or relatively flat and revegetated dump surfaces without the proper aspect and slope conditions will not provide suitable habitat for mule deer in normal winters. An overall loss of habitat is expected and value of this area for winter forage/resting would decline. Alternative F with underground mining has the least impact to mule deer winter range.

Since the TOC for mule deer winter range is defined in the CEA as any disturbance of habitat with a high to moderate RVR, all action alternatives would exceed the TOC. The majority of the direct and cumulative impacts would occur on areas classified by the CEA as moderate RVR mule deer winter range under all action alternatives.

Summer Range

The province for mule deer summer range is defined in the CEA technical guide as the high and moderate RVR areas in watersheds within the Independence Mountains. Direct impacts to potential mule deer summer range in the Jerritt Canyon watershed would be between approximately 253 acres (43 percent) under Alternative F to 319 acres (54 percent) under Alternative D. All action alternatives would result in less than one acre of additional disturbance to potential mule deer summer range in the Burns Creek watershed.

Cumulative short term impacts to potential mule deer summer range, including "islands" of undisturbed habitat, would be approximately 308 acres (52 percent) in the Jerritt Canyon watershed under Alternative F to 374 acres (63 percent) under Alternative D. Long term cumulative impacts to potential mule deer summer range in the Jerritt Canyon watershed would range from approximately 152 acres (26 percent) under Alternative F to 219 acres (37 percent) for Alternative C (Table 4.25). Short term and long term cumulative impacts to potential mule deer summer range in the Burns Creek watershed would be the same for all action alternatives, with disturbance of about three acres and one acre, respectively.

The TOCs for mule deer summer range are the short term disturbance of more than 20 percent of the habitat with a high to moderate RVR or more than 10 percent long term disturbance of these RVR areas. All of the action alternatives would exceed the short term and long term TOCs for mule deer summer range in the Jerritt Canyon watershed. None of the action alternatives would exceed the TOCs for mule deer summer range in the Burns Creek watershed.

Fawning Habitat

The province for mule deer fawning habitat is also the high and moderate RVR areas within watersheds in the Independence Mountains. Direct impacts to potential mule deer fawning habitat in the Jerritt Canyon watershed would be between approximately 216 acres

Table 4.25
Impacts to Jerritt Canyon Watershed Mule Deer Potential Summer Range

Alternative	Direct (Acres)	Cumulative Impacts			
		Short Term[1]		Long Term	
		(Acres)	(%)	(Acres)	(%)
A	0	55	9	1	0.2
B	300	355	60	218	37
C	301	356	60	219	37
D	319	374	63	194	33
E	305	360	61	194	33
F	253	308	52	152	26
G	300	355	60	218	37

Note: [1] Short term cumulative impacts include long term cumulative impact averages.
Province for potential mule deer summer range in the 8,106 acre Jerritt Canyon watershed is about 591 acres in size.

(51 percent) under Alternative F and 241 acres (57 percent) under Alternative D. Alternatives B, C, F, and G would result in about six acres (6 percent) of additional disturbance to potential mule deer fawning habitat in the Burns Creek watershed, while Alternatives D and E would result in approximately four acres (4 percent) of new impacts.

Cumulative short term impacts, including undisturbed "islands" of potential mule deer fawning habitat in the Jerritt Canyon watershed would be between about 260 acres (62 percent) under Alternative F and 285 acres (68 percent) for Alternative D. Long term cumulative impacts in the Jerritt Canyon watershed would range from approximately 117 acres (28 percent) under Alternative D to 158 acres (38 percent) for Alternative F. Long term impacts are greatest under Alternative F because the angle of repose dump face (considered a long term disturbance) on the shortened and smaller South Deep dump is located in a high and moderate RVR area. The other action alternatives would result in direct and cumulative impacts on potential mule deer fawning habitat in the Jerritt Canyon watershed as shown in Tables 4.26 and 4.27.

Short term cumulative impacts to mule deer fawning habitat in the Burns Creek watershed would be about 11 acres (12 percent) for Alternatives D and E to about 13 acres (14 percent) for Alternatives B, C, F, and G. Long term cumulative impacts would be about 7 acres (8 percent) for all action alternatives in the Burns Creek watershed.

Table 4.26
Impacts to Mule Deer Fawning Habitat
Jerritt Creek Watershed

Alternative	Direct (Acres)	Cumulative Impacts			
		Short Term[1]		Long Term	
		(Acres)	(%)	(Acres)	(%)
A	0	44.5	10.6	2.3	0.6
B	231.8	276.3	65.7	141.5	33.7
C	233.3	277.8	66.1	143.4	34.1
D	240.5	285.0	67.8	116.9	27.8
E	235.2	279.7	66.6	117.3	27.9
F	215.4	259.9	61.9	158.0	37.6
G	231.8	276.3	65.7	141.5	33.7

Note: [1] Short term cumulative impacts include long term cumulative impact averages.

Table 4.27
Impacts to Mule Deer Fawning Habitat
Burns Basin Watershed

Alternative	Direct (Acres)	Cumulative Impacts			
		Short Term[1]		Long Term	
		(Acres)	(%)	(Acres)	(%)
A	0	7.4	8.2	4.0	4.5
B	5.6	13.0	14.5	6.7	7.5
C	5.6	13.0	14.5	6.8	7.6
D	3.4	10.8	12.0	6.8	7.6
E	3.4	10.8	12.0	6.8	7.6
F	5.6	13.0	14.5	6.8	7.6
G	5.6	13.0	14.5	6.7	7.5

Note: [1] Short term cumulative impacts include long term cumulative impact averages.

The CEA defines the TOC for mule deer fawning habitat as the short term disturbance of more than 20 percent of the habitat with a high to moderate RVR or more than 10 percent long term disturbance of these RVR areas. All action alternatives would exceed the short term and long term TOCs for mule deer fawning habitat in the Jerritt Canyon watershed. None of the action alternatives would exceed the TOCs for this habitat in the Burns Creek watershed.

Indirect impacts of the proposed mining activities have the potential to affect mule deer over a larger area than indicated for direct effects. Temporary displacement of mule deer has the potential to increase foraging pressure on adjacent areas. However, mule deer are frequently observed in active mining areas and are known to utilize reclaimed areas, so displacement would not be complete. No studies are available to indicate what percentage of the mule deer population would normally occupy active mining and reclamation areas. The carrying capacity of the habitat adjacent to the project area has not been determined, so the magnitude of any indirect impacts from temporary displacement cannot be quantified. Competition for forage with domestic livestock also has the potential to indirectly affect mule deer that may be temporarily displaced. Forage preferences are most similar between mule deer, sheep, and goats. Closure of the Jerritt Canyon Sheep and Goat Allotment by the USFS in December 1992 is expected to leave more available forage for mule deer. Mule deer mortality attributable to heavy equipment and light vehicle traffic has been very low to date at the existing Jerritt Canyon Mine and is not expected to increase as a result of the proposed mine expansion. Closure of the active mining areas to public access since 1980 would continue to provide a "refuge" for mule deer during the hunting season.

Impacts to mule deer have been addressed and mitigation is provided for in a Memorandum of Understanding (MOU) between IMC, USFS, and NDOW, signed March 31, 1993, and a subsequent Habitat Improvement Plan (See Appendix E). This agreement identifies funds IMC has and will continue to contribute to NDOW to fund certain deer habitat management activities. This action mitigates for all past, present, and future impacts to mule deer habitat (up to 5,500 acres of long term impacts to mule deer habitat) in the Independence analysis area. In addition, IMC continues to work with the USFS and NDOW to utilize reclamation practices and plant species in areas to be revegetated that will benefit and support mule deer on mined areas after reclamation.

Sage Grouse

The CEA province for sage grouse is third order watersheds in the Independence Mountain Range. Habitat determined to be important to sage grouse was brooding habitat, which is the limiting factor for the species in this area.

Direct impacts to potential sage grouse brooding habitat in the Jerritt Creek watershed range from approximately 611 acres (16 percent) with Alternative F to 1,115 acres (29 percent) for Alternative D. Direct impacts to potential sage grouse habitat in the Burns Creek watershed vary from 113 acres (9 percent) under Alternatives B and G to 119 acres (10 percent) for Alternative C.

Short term cumulative impacts to potential sage grouse brooding habitat in the Jerritt Creek watershed range from approximately 867 acres (25 percent) under Alternative F to 1,371 acres (40 percent) for Alternative D. Long term cumulative impacts in the Jerritt Creek watershed range from 336 acres (10 percent) under Alternative F to approximately 542 acres (16 percent) under Alternative G. Short term cumulative impacts to potential sage grouse brooding habitat in the Burns Creek watershed range from approximately 297 acres (23 percent) under Alternatives B and G to 303 acres (24 percent) for Alternatives C and D. Long term cumulative impacts in the Burns Creek watershed range from 163 acres (13 percent) under Alternative D to approximately 171 acres (13 percent) under Alternative F. A summary of the direct and cumulative impacts to potential sage grouse brooding habitat is provided in Tables 4.28 and 4.29.

All alternatives exceed the 20 percent high to moderate short term cumulative impact TOC and all alternatives exceed the 10 percent long term cumulative impact TOC to potential sage grouse brooding habitat in the Jerritt Creek watershed. All alternatives exceed both short and long term TOCs for potential sage grouse brooding habitat in the Burns Creek watershed. Consequently, IMC has proposed off-site sage grouse brooding habitat mitigation. In conjunction with the California Mountain Mine Sage Grouse Mitigation Plan, IMC, USFS, BLM, and NDOW have identified sites in which sage grouse brooding habitat can be improved or developed. Refer to Section 2.6 for specific information.

Trout

Trout provide an indication of water quality and of the condition and trend of riparian zones. Sediment yields and flows are expected to decrease in the long-term as a result of pit development in the Jerritt Creek and Burns Creek watersheds. In the short-term, increases in sediment may be observed. The timing of flows in these two streams would be somewhat regulated by the waste rock dumps, which have been observed to release water over a longer period of time than undisturbed drainages. Burns Creek is ephemeral in the upper reaches and perennial at the lower elevations outside of the Project area. This is the only stream that is known to have reproducing fish populations within the Project area. Effects to surface water quantity and quality are discussed in greater detail under surface water resources in Chapter 4. During a study conducted in 1985, a tracer injected in the vicinity of the Burns Basin pit was recovered at a spring in Burns Creek about one-half mile inside the western Project area boundary. This suggests that the spring drains the karst system in the Burns Basin mine area, which may partially offset the predicted reductions in flow within Burns Creek. The spring is located within the segment of Burns Creek known to have trout. Additional information pertaining to the tracer study is provided in the Chapter 3, groundwater resources section.

As indicated in the surface water resources section in Chapter 4, approximately 95 percent of the effects to surface water quality and quantity in Burns Creek are related to the existing operations. A similar relationship would be expected to apply to trout. Cumulative impacts of reduced flow and sedimentation may affect trout.

Table 4.28
Impacts to Jerritt Creek Watershed Potential Sage Grouse Brooding Habitat

Alternative	Direct (Acres)	Cumulative Impacts			
		Short Term[1]		Long Term	
		(Acres)	(%)	(Acres)	(%)
A	0	256	8	117	3
B	1,036	1,292	38	521	15
C	1,077	1,333	39	509	15
D	1,115	1,371	40	445	13
E	934	1,190	35	418	12
F	611	867	25	336	10
G	1,065	1,321	39	542	16

Note: [1] Short term cumulative impacts include long term cumulative impact averages.

Table 4.29
Impacts to Burns Creek Watershed RVR Potential Sage Grouse Brooding Habitat

Alternative	Direct (Acres)	Cumulative Impacts			
		Short Term[1]		Long Term	
		(Acres)	(%)	(Acres)	(%)
A	0	185	15	91	7
B	113	297	23	168	13
C	119	303	24	166	13
D	118	303	24	163	13
E	117	301	24	165	13
F	118	302	24	171	13
G	113	297	23	168	13

Note: [1] Short term cumulative impacts include long term cumulative impact averages.

Golden Eagles and Other Raptors

All action alternatives would disturb habitat in the vicinity of two golden eagle nests within the Jerritt Canyon drainage. Both of these nests were active in 1992 and 1993 (JBR 1993c). Impacts to these nests would be the same for all action alternatives except Alternative F. Alternative F would have less indirect impacts to both nests due to the reduced surface disturbance in the Jerritt Canyon drainage. Both nests may continue to be occupied during project implementation.

Cooper's hawk nests 071 and 072 would be covered by the waste rock dumps developed for the Saval and Steer mine areas under all of the action alternatives. A third Cooper's hawk nest identified as 073 would be removed during the development of 3:1 slopes on one of the Alternative D waste rock dumps.

Ledge-nesting raptor species such as golden eagles, red-tailed hawks, and prairie falcons may gain alternative nesting habitat, as they are known to nest in pit highwalls (Albrechtsen 1987, Fala 1979, Steele 1981). In addition, some increase or decrease in prey or prey availability may be experienced by raptors during and after mining activities. Disturbances from mining could affect up to 2,744 acres under Alternative D, which include habitat areas for raptor prey. Rodent species often inhabit mine areas in spite of the increased disturbance. Also, availability of prey for capture by raptors may be enhanced by lower vegetative cover in active mine areas or on rocky pit walls, pit bottoms, and dump slopes. Some individual raptors or raptor species in the area may be affected by the loss of nest sites and prey base as a result of any of the action alternatives. Lack of vegetative cover in some areas during and after operations could result in some reduction of prey in specific areas. Once mining operations cease, revegetation of disturbances would range from 47 percent of total disturbance under Alternative G to 56 percent under Alternative D.

Cumulative impacts to most raptor species would be negligible, as raptors are wide-ranging and commonly seen in and around active and inactive mining areas in Nevada, including the existing Jerritt Canyon mining operations. Long term effects of mining operations on raptors have not been quantifiably documented. Raptor species may adjust in population numbers due to changes in habitat. Some raptor species, such as forest dwellers, may decrease in population and others such as open area foragers may experience population increases.

Upland Game Birds

Upland game birds including chukar, mourning dove, and gray partridge could also potentially be directly impacted by any of the action alternatives. Some potential chukar habitat, blue grouse habitat and possibly, gray partridge habitat would be lost. These losses would be minor compared with the availability of higher quality habitat for these species outside of the Project area. Mourning doves would not likely be affected by the loss of habitat associated with any of the action alternatives.

Indirect effects on upland game birds may include displacement as a result of equipment noise or other mining related activities. Some upland game birds may not be able to avoid vehicles or construction activities. Other birds would be protected from hunting within the Project area.

Furbearers and Predators

Furbearer habitat is not addressed in the CEA technical guide, except for beavers. Short term reductions in available potential habitat for furbearers would occur during implementation of any of the action alternatives. Direct mortality may occur in situations where animals could not escape vehicular traffic or waste rock dumping.

Carnivores in the Project area, including coyotes, weasels, raccoons, skunks, and badgers would be impacted. Some may be unable to avoid vehicles and construction activities or would not find suitable habitat and be lost to the population. The remainder may be displaced into adjacent undisturbed and unoccupied habitat.

Direct impacts to beavers would be negligible under any of the action alternatives because proposed activities occur upstream of perennial flowing streams and would not change downstream water flows to the point of adversely affecting beaver populations.

Indirect impacts such as noise disturbance from mining activities, including blasting and vehicular traffic, may cause avoidance of active areas by furbearers. Interim and post-mining reclamation activities would re-establish a portion of the furbearer habitat areas, thereby reducing long term impacts. Cumulative impacts would include long term loss of furbearer habitat in areas made uninhabitable due to mining, including portions of some pits that would not be reclaimed and roads that would remain in use after mining.

Mountain lions are not addressed in the CEA technical guide. A limited amount of potential mountain lion habitat would be impacted directly by any of the action alternatives. Though no direct mortality would be expected to occur to lions, there would be some direct loss of habitat due to construction of roads, pits, waste rock dumps, growth medium stockpiles, and other facilities associated with the mine expansion.

Mountain lions may move away from active construction areas, but would continue to make use of other mountainous habitats in the area, with concentration of activity in areas with mule deer. The removal of mule deer habitat may indirectly effect mountain lions by changing the nature of their hunting territory and forcing them to use other areas. All action alternatives, except Alternative F would remove one feline den by development of the New Deep pit.

Cumulative impacts would be slightly higher than direct impacts for all action alternatives with regard to mountain lions due to displacement and habitat loss already occurring within the existing mining areas.

After mining and reclamation, conditions may be suitable for mountain lions to return to mined areas. Reclaimed areas could provide habitat for prey species, and benches, highwalls and other rocky areas created by mining could become potential habitat. Deer are the primary prey species for mountain lions and the long term presence of lions in the Project area would be related to deer densities in the Independence Range.

Other Species

Habitat for most small mammals is not addressed in the CEA technical guide. Small mammals such as shrews would be impacted by a direct loss of habitat. Existing foraging and roosting habitat for bats, such as rock outcrops, aspen stands, springs, and seeps, would be removed under all action alternatives. Some bat roosting habitat may be created if cracks and holes or exposure of solution cavities are created following mining.

Rodent species, including chipmunks, ground squirrels, marmots, mice, rats, gophers, voles, and porcupine would also be affected by a direct loss of available habitat. The habitat required for these species is prevalent throughout the Project area. Consequently, short term and long term impacts would be minimal, as many of these species would re-inhabit some of the mined areas during and after reclamation.

Cottontails, black-tailed jackrabbits, and white-tailed jackrabbits are common throughout the Project area. Direct loss of habitat in the form of forage and shelter would occur and some rabbits would perish as surface disturbance occurs. Other rabbits would flee the disturbance areas and some of these would fall prey to predators. Some of the displaced rabbits would find new niches to occupy. Rabbits unable to find suitable habitat may be lost from the population.

The proposed action would be implemented after the cyclic peak of the rabbit population in Elko County that was noted by NDOW Region II biologists during 1992-1993. Population declines may occur in the short-term due to habitat loss. As interim and final reclamation occur, rabbit populations would be expected to increase due to increases in forage and cover. Cumulative impacts would include long term loss of wildlife habitat in areas made uninhabitable due to mining, including portions of proposed pits that would not be reclaimed and roads that would remain in use after mining.

The CEA province for cavity nesters is third order watersheds in the Independence Mountain Range. Direct impacts to potential cavity nester habitat in the Jerritt Creek watershed would range from about 519 acres (59 percent) in Alternative F to 573 acres (65 percent) under Alternative D. In the Burns Creek watershed, direct impacts would vary from about 140 acres (10 percent) under Alternative E to 171 acres (13 percent) under Alternative C.

Short and long term effects were analyzed according to the CEA model, which defines duration by type of disturbance. Regardless of CEA definitions for short term and long term, it could take several decades for newly planted trees to be used for cavity nesting. Short term cumulative impacts to potential cavity nester habitat in the Jerritt Creek

watershed would range from approximately 645 acres (73 percent) under Alternative F to 699 acres (79 percent) for Alternative D. Long term cumulative impacts in the Jerritt Creek watershed would range from 333 acres (38 percent) under Alternative D to approximately 394 acres (45 percent) under Alternative F. Short term cumulative impacts to potential cavity nester habitat in the Burns Creek watershed would range from approximately 330 acres (24 percent) under Alternative E to 361 acres (27 percent) for Alternative C. Long term cumulative impacts in the Burns Creek watershed would range from 211 acres (15 percent) under Alternative D to approximately 230 acres (17 percent) under Alternative F. A summary of direct and cumulative impacts to potential cavity nester habitat is provided in Tables 4.30 and 4.31.

All action alternatives exceed the 20 percent short term cumulative impact TOC and the 10 percent long term cumulative impact TOC to potential cavity nester habitat in both the Jerritt Creek and Burns Creek watersheds. Long term impacts above the TOC would be partially mitigated by planting aspen as indicated in the preliminary POO and by creating artificial snags for interim nesting. Results of aspen planting in the Independence Range are inconclusive.

The habitat of neotropical migrant bird species is not addressed in the CEA technical guide, and TOCs or RVRs have not been established for these species. As discussed in Chapter 3, neotropical migrant bird species, including songbirds, are numerous and diverse within the Project and general study areas. Those species most likely to be affected by project implementation are those that require specific habitat characteristics for nesting and/or foraging. Canopy-nesting species associated with mature aspen communities would be affected by project implementation, and include warbling vireos (*Vireo gilvus*), hermit thrush (*Hylocichla guttata*), and western tanagers (*Piranga ludoviciana*). Birds associated with the subcanopy layer of willow and chokecherry, including yellow warblers (*Dendroica petechia*), lazuli buntings (*Passerina amoena*) and rufous-sided towhees (*Pipilo erythrophthalmus*) would also be affected by impacts to aspen communities. Generalist species and those associated with more abundant and widely distributed plant communities would also be affected.

4.4 Land Use

Land use within the Project area would shift temporarily to mining operations under all action alternatives. Areas surrounding active operations and inactive or reclaimed mining areas would serve as wildlife habitat during project operations.

Post-mining land use objectives include providing for wildlife habitat, livestock grazing, recreational opportunities, public access, watershed stability, and visual quality consistent with established classifications. These post-mining land use objectives would be accomplished using a variety of reclamation and final closure methods that vary by alternative.

Table 4.30
Impacts to Jerritt Creek Watershed RVR Potential Cavity Nesters Habitat

Alternative	Direct (Acres)	Cumulative Impacts			
		Short Term[1]		Long Term	
		(Acres)	(%)	(Acres)	(%)
A	0	126	14	28	3
B	548	674	77	383	44
C	550	676	77	384	44
D	573	699	79	333	38
E	560	686	78	347	39
F	519	645	73	394	45
G	548	674	77	383	44

Note: [1] Short term cumulative impacts include long term cumulative impact averages.

Table 4.31
Impacts to Burns Creek Watershed RVR Potential Cavity Nesters Habitat

Alternative	Direct (Acres)	Cumulative Impacts			
		Short Term[1]		Long Term	
		(Acres)	(%)	(Acres)	(%)
A	0	190	14	141	10
B	147	337	25	223	16
C	171	361	27	219	16
D	143	333	24	211	15
E	140	330	24	214	16
F	166	356	26	230	17
G	147	337	25	223	16

Note: [1] Short term cumulative impacts include long term cumulative impact averages.

With the exception of the pits and some angle of repose slopes on waste rock dumps, the area would be revegetated for use as livestock range and wildlife habitat. Use by livestock would be enhanced by creation of flatter slopes on the surfaces of the waste rock dumps.

Rock piles would be placed on the undulating dump surfaces as potential wildlife habitat. The outer edges of coarse and durable waste rock used to cover the angle of repose slopes adjacent to forage may serve as habitat for rodents, which are prey for mammalian and avian predators. Ledge-nesting raptors such as golden eagles, red-tailed hawks, and prairie falcons may utilize the pit benches and highwalls for nesting. Solution cavities and cracks exposed by the mining operations could provide roosting habitat for bats and nesting sites for cliff-dwelling bird species. The mitigation measures described for all of the action alternatives in Chapter 2 would provide for additional wildlife habitat and livestock range.

Reclamation and final closure operations would re-establish public access into portions of the disturbance areas under all of the action alternatives. This is described in greater detail in the section on public access. This would result in re-establishment of the major recreational use of the area, hunting. The relatively flat dump surfaces may also promote use of the area by campers or other recreational users. Public access would be restricted around the pits and any underground openings for safety reasons.

An anticipated stable watershed would exist after mining and reclamation. This would be accomplished through proper dump construction, development of adequate under-dump drainage systems or trench drains, armoring angle of repose slopes with coarse and durable waste rock, growth medium redistribution and revegetation. Best management practices would be used to meet baseline conditions and/or applicable state and federal water quality standards.

The Forest Service visual quality objective for the area disturbed by mining is maximum modification. All of the alternatives would meet this objective.

Land Use Planning and Management

NEPA regulations require discussion of possible conflicts with federal, regional, state, and local land use plans. All alternatives would be consistent with the Humboldt National Forest LRMP, which provides for multiple land uses. Alternative A may be in possible conflict with Elko County's draft policy that mining on federal lands should remain open and free to the public. If Alternatives D and E were not implementable by IMC because of associated costs of development, these alternatives may also be in conflict with Elko County's stated land use policy.

Mining

Direct and indirect effects to mining would be similar for all action alternatives. Mining would be the predominant land use within the Project area during the life of the

Project. The amount of ore mined would be similar under all action alternatives except for Alternative F, which would result in less ore production. A more detailed discussion of ore production and geologic resources is included in the geology section of Chapter 4. Under Alternative A, mining operations would cease and no additional ore would be produced from this area in the near future.

Livestock Grazing

The analysis areas for direct, indirect, and cumulative impacts to forage resources are the individual grazing allotments within the Humboldt National Forest in the Independence Range. Direct and cumulative impacts are analyzed in terms of the removal of forage classified as high and moderate resource value ratings (RVRs) for the type of livestock permitted on an allotment. High and moderate RVR areas for cattle and horses are defined as areas having slopes of 30 percent or less with plants that have a medium to high forage value that are less than one mile from a water source.

Alternative A - No Action

There would be no impacts to livestock grazing under the No Action Alternative other than those analyzed in previous NEPA documents.

Effects Common to All Action Alternatives

Two cattle and horse allotments, Schmitt Creek and Jerritt Canyon, would be affected by implementation of any of the action alternatives.

The direct impact to high and moderate RVR forage on the Schmitt Creek allotment would range from five percent of total allotment area (132 acres) for Alternative E to six percent of the total allotment area (164 acres) for Alternative C. Short term cumulative impacts to high to moderate RVR forage would range from sixteen percent (436 acres) for Alternative E to seventeen percent (468 acres) for Alternative C. Long term cumulative impacts would range from nine percent (251 acres) under Alternative D to ten percent (272 acres) under Alternative F (Table 4.32). There would be no reductions in Animal Unit Months (AUMs) to the Schmitt Creek allotment under any action alternative. Reductions were previously made in anticipation of the mine's expansion and existing operations.

The direct impact to high to moderate RVR forage on the Jerritt Canyon cattle and horse allotment would range from 17 percent (151 acres) for Alternative F to 28 percent (245 acres) for Alternative D. Short term cumulative impacts to high to moderate RVR forage would range from 20 percent (183 acres) for Alternative F to 31 percent (277 acres) for Alternative D. Long term cumulative impacts would range from six percent (56 acres) under Alternative D to nine percent (82 acres) under Alternative C (Table 4.33).

The impact to forage resources under all action alternatives would be below the short term cumulative impact threshold of concern (TOC) of 20 percent and the long term cumulative impact of 10 percent for the Schmitt Creek Allotment (Table 4.32). Impacts

Table 4.32
Impacts to Schmitt Creek Cattle and Horse Allotment High and Moderate RVR Potential Forage

Alternative	Direct (Acres)	Cumulative Impacts			
		Short Term		Long Term	
		Acres	%	Acres	%
A	0	304	11	179	6
B	139	443	16	260	9
C	164	468	17	261	9
D	135	439	16	251	9
E	132	436	16	254	9
F	159	463	17	272	10
G	139	443	16	260	9

Table 4.33
Impacts to Jerritt Canyon Cattle and Horse Allotment High and Moderate RVR Potential Forage

Allotment	Direct (Acres)	Cumulative Impacts			
		Short Term		Long Term	
		Acres	%	Acres	%
A	0	32	3	3	0.4
B	205	237	26	81	9
C	207	239	27	82	9
D	245	277	31	56	6
E	227	259	29	61	7
F	151	183	20	74	8
G	205	237	26	81	9

from all action alternatives exceed the 20 percent short term cumulative impact TOC for the Jerritt Canyon Allotment. However, the 10 percent long term cumulative impact TOC would not be exceeded (Table 4.33).

Some areas, such as mine pits, would be permanently lost to livestock grazing because they would not be revegetated. Some steep slopes remaining after reclamation would experience little or no use by livestock. The majority of the waste rock dump disturbance areas would consist of relatively flat surfaces after reclamation, as described in Section 4.2. Flat dump surfaces are expected to have the highest revegetation potential of all the disturbance areas. The greatest area of relatively flat dump surface would be created under Alternative C. This alternative would result in up to 1,065 acres of relatively flat dump surface. Of the open pit mining alternatives, the smallest area of flat dump surface would be created under Alternative D resulting in the development of up to 889 acres of relatively flat dump surface. The 503 acres of 3H:1V dump slopes created under Alternative D would not qualify as high to moderate RVR forage areas after revegetation because of the 30 percent slope restriction on these areas. Overall, Alternative F would have the least acreage of flat dump surface because the South Deep dump would be eliminated. This dump represents about 76 percent of the total dump disturbance area.

The other allotments (East Independence, Snow Canyon, Foreman Creek) within the general study area would not be measurably impacted by any of the action alternatives. Stocking rates for these allotments would not change to absorb any AUMs lost on the Jerritt Canyon cattle and horse allotment.

IMC has agreed to maintain about 23 miles of allotment boundary and pasture fences surrounding the existing mining operations to assist in range management and to prevent livestock from entering the mine areas for safety reasons. The seed mixes utilized during revegetation operations would include plants which are used by livestock to mitigate for impacts to forage resources.

Effects Common to Alternatives B, C, D, E, and G

The Jerritt Canyon cattle and horse allotment would be directly impacted by any of the action alternatives. This allotment is comprised of three grazing units: Dry Creek, Pot Holes, and Jerritt Canyon. Alternatives A through E and G involve development of the New Deep, Burns Basin, Saval, and Steer deposits as open pit operations. All direct effects from the mine expansion would be limited to the Jerritt Canyon Unit. The Jerritt Canyon unit would be closed during operations and reclamation under any of these alternatives. This closure would result in a reduction of 475 animal months. This is a 63 percent reduction of the current permitted 750 animal months. The Dry Creek and Pot Hole units would remain open and available for grazing.

Alternative F

The Jerritt Canyon allotment would be affected by implementation of Alternative F. Alternative F combines open pit operations for Saval, Steer, and Burns Basin and

underground operations for the New Deep deposit in the Project area. Implementation of this alternative would result in the partial closure of the Jerritt Canyon unit during operations and reclamation. This partial closure would result in a reduction of the permitted numbers from 750 animal months to 537 animal months. This reduction of 213 animal months is a 29 percent reduction in permitted numbers. The Dry Creek and Pot Hole units would remain open and available to grazing.

Cumulative Effects

Mining operations in the southern portion of the Independence Range have directly impacted 2,537 acres of rangelands previously available for domestic livestock grazing. Beginning in 1986 with the Burns Basin Open Pit Mine, 537 acres were directly impacted, representing a loss of 442 AUMs on the Mill Creek cattle and horse allotment and 190 AUMs on the Schmitt Creek cattle and horse allotment. In 1993 the Jerritt Canyon sheep and goat allotment was closed, as acreage impacted by mining activity was approaching 50 percent of the allotment. This resulted in the displacement of 1,200 head of sheep, representing a loss of 896 AUMs. As mining activity has increased over the past eight years, allotment boundaries have changed and some allotments have been absorbed into adjacent areas. This has been the case with Warm Creek cattle and horse, Winters Creek cattle and horse and Mill Creek cattle and horse allotments. Under any of the action alternatives, effects to the Jerritt Canyon cattle and horse allotments would result in further reductions during mining operations. The reductions in permitted numbers may not be permanent. Following reclamation and successful revegetation, the USFS would assess the affected allotments for re-instatement of livestock grazing.

Recreation and Public Access

Recreation

The area of analysis for recreation is the Independence Range, with emphasis on the general study area. Potential effects on hunting and fishing were raised as issues during public scoping and are the focus of the analysis of proposed mining expansion impacts on recreational resources. Also addressed are the TOC for cumulative effects as defined by the CEA model.

Alternative A - No Action

Existing mining operations have resulted in the closure of certain areas for public safety. These areas are described in the "Public Access" section of Chapters 3 and 4. Portions of the closed area were formerly accessed for hunting purposes. Due to the ephemeral nature of the streams and drainages, there has been no impact to recreational fishing in the existing closure area. These conditions would be expected to continue under this alternative until mining has ceased and the area is reopened for public access.

Effects Common to All Action Alternatives

Existing hunting opportunities in the Independence Mountain Range would not be substantively impacted by the proposed mining expansion under any alternative. The existing closure area would be expanded to the west for safety purposes, and hunting access would thus be restricted in this area. Hunting opportunities would still be possible outside of the closed area. Hunters would still be able to access portions of the general study area via numerous FS-administered roads, including Jerritt Creek (USFS #875), China Creek (USFS #136), Snow Canyon Creek (#368), and Gance Creek (#868). Mining operations may temporarily require wildlife, including deer, to seek habitat outside of the proposed disturbance areas. Many areas within the proposed closed area would be undisturbed and deer have been observed adjacent to active pits, waste rock dumps, and haul roads. No studies are available to indicate what percentage of the population would normally occupy such an area during mine activity. The protection from hunting afforded wildlife in the closure areas may attract game animals during the hunting season, thereby reducing hunting opportunities. Hunting opportunities exist throughout the Independence Range.

There would be no direct impacts to recreational fishing as a result of the proposed mining expansion. No mining operations or closures are proposed for areas which currently support reproducing fish populations. Other impacts to fish are described in the aquatic resources section of Chapter 4.

Cumulative Effects

The CEA province for cumulative effects is the Independence Range. The TOC for recreational opportunity is any reduction in primitive and semi-primitive nonmotorized opportunity classes. There are no areas classified for recreational opportunity as primitive or semi-primitive non-motorized in the Project area. The TOC for recreational use is where demand is expected to exceed supply. Additional population growth in Elko County is possible as a result of various in-migration factors (See Socioeconomics-Population, Chapter 4) and could result in additional demand for recreational opportunities. As described in Chapter 3, the Independence Range is one of many public recreation areas in Elko County. Overall demand for recreational use is not expected to exceed supply in the Independence Range during Project operations.

Once mining operations have ceased and public access is reopened, recreational opportunities should resume in most of the area that was closed for public safety. Some pit areas may continue to be closed for safety reasons.

Public Access

The availability of access to public lands is directly related to the public's ability to recreate on those lands. The detailed analysis area for project impacts is the proposed Project area. The Independence Range is the CEA province for analysis of cumulative effects. The following criteria were used to identify effects to public access: (1) change in

public access on existing roads, (2) project-related changes that affect duration, quantity, and type of impact to public access, and (3) loss of USFS Public Access Class 1 or 2 areas.

Alternative A - No Action

Under the No Action Alternative the existing area closed to public access would remain closed until final reclamation of the existing mine operations is completed and existing public access restrictions are lifted by the USFS.

Effects Common to All Action Alternatives

In the interest of public safety, the existing closure area would be expanded to the west to restrict access to the New Deep, Saval and Steer mine areas under all action alternatives. The existing gate on the Jerritt Creek Road (#875) would be temporarily relocated approximately one and a half miles downstream and the Arana road gate would be relocated less than one quarter mile to the west (See Map 2.4 in Chapter 2).

Under all action alternatives the mining expansion would result in an estimated additional 2,695 acres of Class 4 area, the Public Access class for areas totally closed for public safety. With the exception of the one and a half miles of the Jerritt Creek Road and a quarter mile of Arana Road, there are no other roads open to the public within the Project area. The majority of the Project area is therefore not readily accessible under existing conditions. The primary project-related change in quantity of access would therefore fall within a narrow corridor along the additional one and half miles proposed for closure on the Jerritt Creek road and the quarter mile of Arana Road.

After mining operations cease and final reclamation is completed, the area would be reopened to public access. Vehicular access would be restricted in portions of the area that cannot be practically made safe by means of earthen berms or other methods.

At the discretion of the USFS, portions of haul roads and/or exploration and other roads may be left in place after reclamation, specifically to provide access within the former mining area. These roads would provide access to the flat surfaces of dumps. Where possible, these roads would provide continuous routes that connect with other USFS roads outside the former mining area.

Under Alternatives B and G, the proposed dump in the Burns Basin area could potentially impact an access road kept open during operations for grazing allotment purposes, but not for general public access. IMC would make adjustments as necessary to keep this road or an alternate route open.

Cumulative Effects

Jerritt Mining Operations Area

Past and current mining operations have resulted in an existing closure area of 7,347 acres. Prior to mining, the area had been open to access in a manner similar to Class 2 - generally open access with no easements (Whalen, pers. comm.). Roads provided vehicular access from the west up Jerritt Creek and Burns Creek to a north-south route that generally followed the divide with access routes to the east along Sheep Creek and California Creek. Many of these roads were not Forest Development Roads and therefore not maintained by the USFS. The Forest Transportation Plan allows closure of these roads if there are significant conflicts with other resources. A rough four-wheel drive trail also provided access up Mill Creek to the Steer Canyon drainage divide (Clarke, pers. comm.) Portions of the roads on the western side of the divide became inaccessible when the area was closed for safety purposes. The north-south route from California Creek to Gance Creek formed the southeastern boundary of the closed area and remained open until 1993, when a portion of the road was temporarily closed for the California Mountain mining operations. The portion of the route closed for the California Mountain operations is scheduled to reopen by 1995-1996, when the project is completed.

The roads described above have historically been used by the public. Much of the area that has been or would be temporarily closed for past mining and proposed expansion operations has had limited access via maintained or mapped roads. There were no roads to the north of Jerritt Creek in sections 28, 29, 31, 32 and 33 of T41N, R53E, or between Jerritt Creek and Mill Creek in sections 8, 9, and most of sections 16, 17 and section 21 of T40N, R53E (Forest Visitor/Travel Map, Mountain City and Jarbidge Ranger Districts, 1990 and Clarke, pers. comm.).

Once reclamation is completed for mining-related projects in the area, the closed area would be re-opened with some safety restrictions. Portions of mining operation roads would be left to provide access to flat portions of dumps and to other roads with access over to the Independence Mountain divide. Final access road configurations would be subject to review by the USFS, but the potential exists for access to be improved over existing and pre-mining conditions by the addition of these routes. The short-term closure of portions of pre-mining roads would be an irretrievable loss of use for that period, but access would be restored in the long-term.

Access to the USFS boundary from Highways 225 and 226 is another factor that may cumulatively affect use of public roads on National Forest System land. Access to the Project area requires use of private roads across private lands. By definition, the Class 2 area is "generally open access with no easements." Typically this means that although a road has no public easements, the landowner has historically allowed access to the USFS boundary. In many cases, landowners can refuse access in areas where they previously allowed it (Keister, pers. comm.).

Independence Mountain Range

The CEA province for cumulative effects to access is the Independence Range. The TOC is any loss of Class 1 or 2 areas. A total of 8,463 acres is currently closed in the Independence Range. An estimated additional 2,695 acres of existing Class 2 area would be closed, resulting in a cumulative closure area of 11,158 acres.

4.5 Socioeconomic Environment

Socioeconomic impacts are closely related to the mine economics issue identified during public scoping. Actions or decisions which influence the economic feasibility of the mining operations would also be reflected in the socioeconomic environment. Mine economics were raised as an issue by the public because of the effect that mine economics have on employment levels, property tax payments, net proceeds of mining tax revenues, and local purchases by IMC. All alternatives are assumed to be economically feasible to implement for analysis purposes throughout this FEIS. A comparison of the total estimated costs by alternative is displayed in Table 4.34. A base level of $0 was assigned to Alternative B to evaluate the added costs of implementing Alternatives C, D, E, F and G.

The costs of implementing Alternatives D and E are significant from a mine economics perspective, as shown in Table 4.34. It is estimated that Alternative D would add approximately $35 million and Alternative E would add approximately $17 million in costs over those incurred with implementation of Alternative B to produce an equivalent amount of gold. Alternative C is estimated to cost slightly more than Alternative B to implement. The high costs of implementing Alternatives D and E may be prohibitive to implementation of the proposed mine expansion under current gold prices.

This section evaluates potential changes to existing social and economic conditions that may result from the proposed action or the alternatives. Expansion of the Jerritt Canyon mine would allow operations to continue for a minimum of another nine to ten years (2001 to 2002) based on current (1993) mine economics. Implementation of the proposed action alternative would result in sustained employment along with increased employment opportunities, further diversification of the local economy, and continued payments of local, state and federal taxes by IMC and its employees. Local government fiscal conditions are particularly dependent on sustained economic activity and continued revenues from sales and use taxes, property taxes and net proceeds of mine taxes. Without the proposed expansion, IMC anticipates mining operations would begin to decline in 1994 and would cease sometime before or during 1996 (IMC 1993a). This would result in the lay-off of about 600 employees, the loss of revenues from property taxes, and a reduction in the payment of other taxes and the local purchase of goods and services.

Direct and indirect effects resulting from the proposed action have been analyzed, taking into account recent trends in Elko County. Cumulative effects have been evaluated utilizing the best available information regarding other project proposals, other than the Jerritt Canyon expansion, which have potential impacts in Elko County.

Table 4.34
Relative Costs by Alternative

	Alt-B[1] Base Level ($MM)	Alt-C ($MM)	Alt-D ($MM)	Alt-E ($MM)	Alt-F ($MM)	Alt-G ($MM)
Steer & Burns						
Dumps						
Hauling	$0.00	$0.49	$15.18	$15.18	$0.00	$0.00
Dozing 3:1	$0.00	$0.81	$0.81	$0.80	$0.00	$0.00
Reclamation	$0.00	$0.30	$0.49	$0.33	$0.02	$0.00
Road Reclamation	$0.00	$0.01	$0.02	$0.01	$0.00	$0.00
Total	**$0.00**	**$1.61**	**$16.50**	**$16.32**	**$0.02**	**$0.00**
Saval						
Dumps						
Hauling	$0.00	$0.00	$4.85	$0.25	$0.00	$0.00
Dozing 3:1	$0.00	$0.00	$0.54	$0.27	$0.00	$0.00
Reclamation	$0.00	$0.00	$0.44	$0.03	$0.00	$0.00
Road reclamation	$0.00	$0.00	$0.01	$0.00	$0.00	$0.00
Total	**$0.00**	**$0.00**	**$5.84**	**$0.55**	**$0.00**	**$0.00**
New Deep						
Dumps						
Hauling	$0.00	$0.00	$6.39	$0.00	$0.00	$0.00
Dozing 3:1	$0.00	$0.25	$1.00	$0.61	$0.00	$0.00
Reclamation	$0.00	$0.27	$0.82	$0.26	$0.00	$0.00
Road reclamation	$0.00	$0.00	$0.12	$0.00	$0.39	$0.20
Total	**$0.00**	**$0.52**	**$8.33**	**$0.87**	**$0.39**	**$0.20**
Additional Equipment	$0.00	$0.00	$4.46	$0.00	$0.00	$0.00
TOTAL COSTS (in millions)	**$0.00**	**$2.13**	**$35.13**	**$17.74**	**$0.41**	**$0.20**

Source: IMC July 1993.

Note: [1] Costs for Alterative B were assumed to be $0 for purposes of comparison.

Key socioeconomic issues identified in the scoping process include: potential effects on employment; effects on Elko County; potential effects to tax structure and revenues to the county; and community stability, including the length of operations. Timing and duration of mining operations and effects on the economy and employment are discussed under Economy and Employment. Effects to Elko County are discussed under the following sections: Population; Housing; and Public Facilities and Services (including schools). Impacts to tax structure and revenues to the county are discussed under Financial Resources. Other topics analyzed include power, communications, transportation and energy.

Analysis methodologies are based on traditional planning practices and include observations of trends and patterns in the study area, State of Nevada population projections, information from economic impact studies conducted by the University of Nevada-Reno, and information from other local, state and federal agencies.

The analysis area for evaluating socioeconomic impacts is Elko County. It is expected that the City of Elko and the unincorporated Spring Creek community would be the areas most impacted by the proposed action. However, many facets of the entire County's economic base are reliant on the revenues generated by the Jerritt Canyon project. In addition to the proposed expansion, there are seven other major projects proposed or planned in Elko County and surrounding counties which are expected to affect the socioeconomic environment in Elko County in the reasonably foreseeable future. Other than the proposed action, only Barrick's proposed Meikle project would be located in Elko County. It is assumed that many new employees at projects that would be located in Eureka and Lander counties would choose to live in Elko, Carlin and Spring Creek where housing, goods, services and public facilities are available. These projects include: Placer Dome, U.S.'s Pipeline Project; Santa Fe Gold's Mule Canyon Mine; Newmont's Roaster Plant and Gold Quarry Expansion; and Dee Gold's Expansion and Underground Projects. Combined duration of these projects is anticipated to extend from 1993 to 2011, with all projects expected to begin construction activities or come on line from 1993 to 1997. Cumulative effects of these projects are discussed under the appropriate sections.

Population

Elko County population would not change significantly upon implementation of the proposed action. A maximum increase of less than two percent over the 1993 estimated population of 39,000 could be expected from in-migration related to new project-related mining employment and secondary support and service industry job opportunities. It is estimated that approximately 43 percent of the new employees required for the project would be hired locally.

Growth rates for Elko County are expected to continue at a moderate increase, peaking in 1993-94 at 3.8%, then slowing to less than 2% per annum through 1998. Table 4.35 indicates that the total percent growth in the county over the next five years, 1993 to

1998, would be 11.8% at an average annual rate of 2.3% based on these projections (Nevada State Demographer 1993).

Table 4.35
State Demographer's Population Estimates and Forecasts 1992-1998

	Elko County	City of Elko[1]	City of Carlin[1]	Eureka County	State of Nevada
1992	37,740	16,580	2,270	1,580	1,343,930
% >[2] 92-93	3.3			0.6	3.3
1993	39,000			1,590	1,388,630
% > 93-94	3.8			0.0	3.6
1994	40,470			1,590	1,438,560
% > 94-95	2.5			0.6	3.3
1995	41,480			1,590	1,485,720
% > 95-96	1.7			0.0	3.5
1996	42,190			1,600	1,536,980
% > 96-97	1.6			0.0	3.2
1997	42,870			1,600	1,586,280
% > 97-98	1.8			0.0	3.4
1998	43,640			1,600	1,640,390
% > 93-98	11.8			0.0	18.1

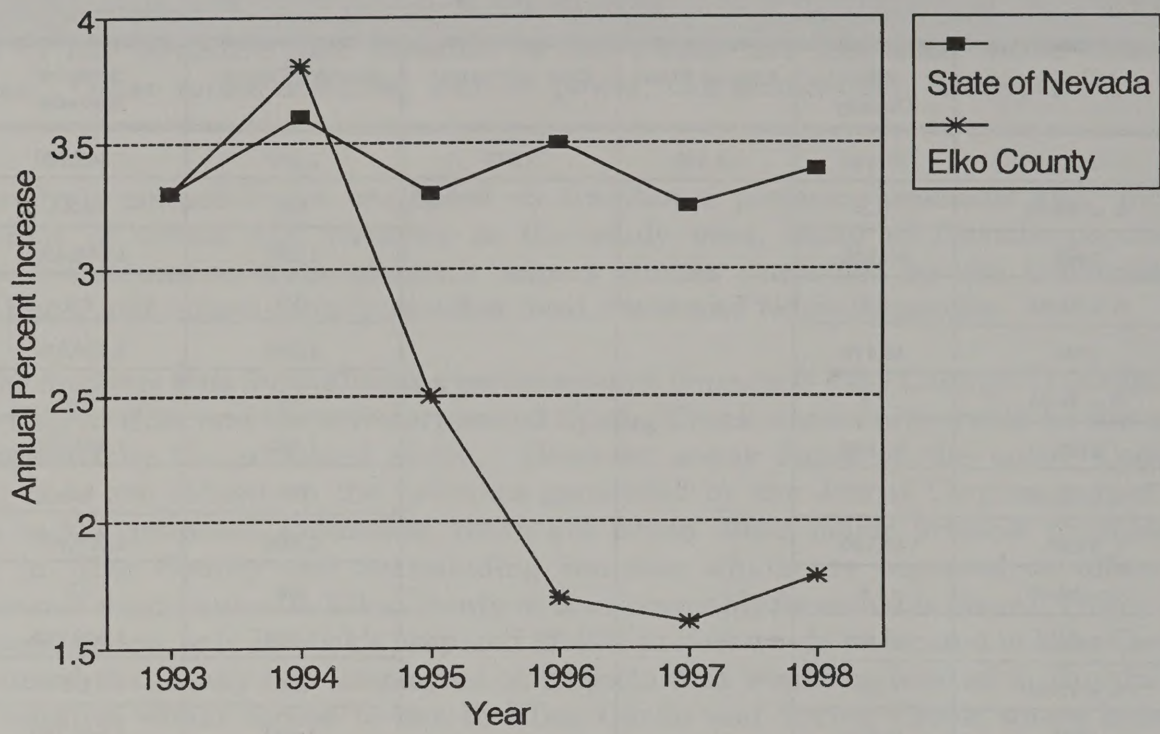
Source: Nevada State Demographer 1993. Bureau of Business & Economic Research, College of Business Administration, University of Nevada, Reno.

Note: Forecasts and estimates for July 1 of each year.
[1] The State Demographer does not project population for these cities.
[2] > means increase.

The five-year forecast for 1993 to 1998 suggests that a stabilizing trend is developing in Elko County, with annual growth rates subsiding to less than those forecast for the state as a whole for this period (See Figure 4.1). This trend corroborates the predictions of economist John Dobra, Ph.D., who suggested in 1991 that growth rates in the Elko County area would begin to decline into the foreseeable future as mining industry production in the region reached a plateau (USDI, BLM 1991b).

Projected direct and indirect population increases which may be expected upon implementation of the proposed action are displayed in Table 4.36. Direct population is associated with new mining jobs and is calculated as one household per in-migrating mining

Figure 4.1
County and State Population Forecast
1993 to 1998



employee times the average Elko County household size of 2.79 (US Bureau of the Census 1990). Indirect population is associated with new secondary service and supply industry jobs induced by new mining industry jobs. It is assumed that 70 percent of indirect jobs would be filled by second persons in primary job households or by current residents of Elko County (ENSR 1991).

Alternative A - No Action

No population growth from in-migration associated with expansion of the Jerritt Canyon Mine would occur under this alternative. If the proposed action were denied, or an economically infeasible alternative selected, IMC anticipates that production and employment would begin to decline in 1994 and cease sometime before or during 1996 based on current mine economics (IMC 1993a). The loss of 600 direct mining jobs could cause lay-offs and job losses affecting up to 750 employees in secondary support and service industries. Some of the affected workers could possibly migrate out of the county if other employment were not locally available.

Table 4.36
Summary of Project-Related Impacts Employment, Population, Schools For Alternatives B, C, D, E, F, and G[1]

	Direct Mining & Construction				Indirect Service & Support				Total Direct and Indirect			
Alternative[2]	B & C	D & E	F	G	B & C	D & E	F	G	B & C	D & E	F	G
New Employment												
Temporary[3]	30	30	30	30	19	19	19	19	49	49	49	49
Permanent[4]	175	200	155	270	122	140	109	190	297	340	264	460
Subtotal	**205**	**230**	**185**	**300**	**141**	**159**	**128**	**209**	**346**	**389**	**313**	**509**
New Households												
Temporary	16	16	16	16	6	6	6	6	22	22	22	22
Permanent	99	113	88	153	37	42	32	57	136	155	121	210
Subtotal	**115**	**144**	**104**	**169**	**43**	**48**	**38**	**63**	**158**	**177**	**143**	**232**
New Residents												
Temporary	19	19	19	19	17	17	17	17	36	36	36	36
Permanent	276	315	245	427	103	117	92	159	379	432	337	586
Subtotal	**295**	**334**	**264**	**446**	**120**	**134**	**109**	**176**	**415**	**468**	**373**	**622**
New School-Age												
Temporary	2	2	2	2	7	7	7	7	9	9	9	9
Permanent	124	141	110	191	46	53	41	71	170	194	151	262
Subtotal	**126**	**143**	**112**	**193**	**53**	**60**	**48**	**78**	**179**	**203**	**160**	**271**

Source: IMC, August 1993. New direct employment projections. GeoResearch, Inc., September 1993. Indirect employment, new households, new residents, new school-age projections.

Notes:
1. Under Alternative A there would be no new employment, households, residents, or school-age children, based on IMC employment projections.
2. Actual employment levels, households, residents and school-age children would be dependent upon the economic feasibility of Alternatives D and E, as well as the technical logistics and economic feasibility of Alternatives F and G.
3. Temporary Positions (less than one year); construction workers.
4. Permanent Positions (one year or more); mining operations workers; projected peak employment levels for the various alternatives are displayed here and were used as the basis for indirect industry employment, new households, new residents, and new school-age projections.

Alternative B - Proposed Action & Alternative C

Alternatives B and C would result in the creation of 175 new permanent job opportunities at IMC. The total population increase in Elko County related to in-migration associated with expanded mining industry jobs and indirect service sector job opportunities under these alternatives would be approximately 415. Direct mining employment-related population would be 295 with an indirect increase of 120 occurring as a result of new secondary employment. Based on a 1993 estimated county population of 39,000 (Nevada State Demographer 1993), a one percent increase would result from direct and indirect employment-related in-migration. It is assumed that new residents would live primarily in Elko and Spring Creek where most available housing is likely to be located.

Alternatives D & E

The creation of up to 200 new permanent mining jobs at IMC under Alternatives D and E would result in about 140 indirect employment opportunities. County population would rise by a total of about 432 permanent residents, which is an increase of approximately one percent over the estimated 1993 population.

Alternative F

The addition of 155 permanent mining jobs at IMC under this alternative would result in a total population increase of 373 in the county. Direct and indirect increases would be 264 and 109, respectively. An increase of less than one percent over 1993 population would result.

Alternative G

A total of 270 new permanent job opportunities at IMC would be created under this alternative. The greatest potential for population growth would result from this alternative, with a possible increase of 1.6 percent over the 1993 level. A total of 622 new residents, 446 direct employment-related and 176 indirect employment-related, could migrate into the county to take advantage of new job opportunities.

Cumulative Effects

Summaries of reasonably foreseeable impacts to employment, population and schools which may result from projects other than the Jerritt Canyon Expansion are displayed in Table 4.37.

In addition to the in-migration expected to result from the proposed action, a total of 2,097 new permanent residents could settle in Elko County over the next five years (1993 to 1998) as a result of expanded direct and indirect job opportunities related to the projects listed under on Table 4.37. Another 2,556 people (construction-related workers and their families) could reside temporarily in Elko County during construction seasons from 1993 to

Table 4.37
Summary Of Reasonably Foreseeable Impacts Other than Jerritt Canyon Expansion Employment, Population and Schools

DIRECT IMPACTS

	Regional Employment[1]		New Elko Co. Households[2]		New Elko Co. Residents[2]		New School-age Residents[2]	
Company/Project	**Temp.**	**Perm.**	**Temp.**	**Perm.**	**Temp.**	**Perm.**	**Temp.**	**Perm.**
Placer Dome, U.S./ Pipeline Project	285	265	200	185	236	516	25	231
Santa Fe Gold/ Mule Canyon Mine	500	350	250	175	295	488	31	219
Barrick/ Meikle Project	250	220	137	209	161	583	17	261
Newmont/ Gold Quarry Exp.	760	0	418	0	493	0	52	0
Newmont/ Roaster Plant	200	0	110	0	130	0	14	0
Dee Gold/ Expansion	70	30	38	28	45	78	5	35
Dee Gold/ Underground	30	0	16	0	19	0	2	0
Total Direct	**2,095**	**865**	**1,169**	**597**	**1,379**	**1,464**	**146**	**746**

INDIRECT IMPACTS[3]

	New Elko Co. Employment		New Elko Co. Households		New Elko Co. Residents		New School-age Residents	
Company/Project	**Temp.**	**Perm.**	**Temp.**	**Perm.**	**Temp.**	**Perm.**	**Temp.**	**Perm.**
Placer Dome, U.S./ Pipeline Project	240	229	72	69	201	192	90	86
Santa Fe Gold/ Mule Canyon Mine	300	217	90	65	251	181	112	81
Barrick/ Meikle Project	250	220	137	209	161	583	17	261
Newmont/ Gold Quarry Exp.	502	0	151	0	421	0	189	0
Newmont/ Roaster Plant	132	0	40	0	112	0	50	0
Dee Gold/ Expansion	46	37	14	11	39	31	17	14
Dee Gold/ Underground	19	0	6	0	16	0	7	0
Total Indirect	**1,403**	**756**	**422**	**227**	**1,177**	**633**	**526**	**283**
Grand Total	**3,498**	**1,621**	**1,591**	**824**	**2,556**	**2,097**	**672**	**1,029**

Sources: [1] BLM, 1993. Best available information regarding proposed/planned projects expected to impact Elko County (Davis, pers. comm.). (IMC provided employment figures for Jerritt Canyon Expansion.)
[2] GeoResearch, Inc. 1993 (new households, residents, school age).
[3] GeoResearch, Inc. 1993.

1998. Maximum construction work force estimates were used for impacts analysis which presents an overstated projection for temporary population influxes. However, it is expected that the temporary labor pool would migrate from project to project as work is available, therefore cumulative effects would likely be less than the potential impacts displayed in Table 4.37. Peak influxes of temporary residents would probably occur between 1993 and 1995, when most construction would be scheduled. The resultant total percent population increase would be seven percent over the 1993 estimated population of 39,000. This seven percent increase would occur incrementally over the 1993 to 1998 period as proposed projects come on line.

Economy and Employment

The local economy would be further stimulated and diversified by creation of new mining sector jobs. Studies of the economic impacts of Nevada's mineral industry revealed that for every mining job, an additional 0.74 jobs were created in the local economy and 0.5 jobs were created in the urban economies of the state which serve as supply centers (Dobra 1989). For analysis purposes, Elko is considered a supply center and it is assumed that 1.24 additional jobs would result from each new permanent mining job.

The local economy would also be stimulated by increased purchases of goods and services by IMC, its employees and by indirect employment workers. A healthy local economy is critical to the financial well-being of local governments, particularly in Nevada, where economic volume drives the tax base (Chapman, pers. comm. June 3, 1993).

Projected employment levels and duration of operations by alternative are presented in Table 4.38. Under Alternatives B, C, D, E, F and G, thirty construction workers would be required to build new mine facilities for a duration of approximately six months beginning in the summer of 1994. At an average 1991 state construction industry wage of $28,709 per year, 30 construction workers would be paid $430,635 over a six month period. No new mining operations or construction workers would be employed under Alternative A. Reclamation and final closure activities that would be undertaken after the mining operations end would require fifty employees for a period of two years under Alternative A and three years for Alternatives B, C, F and G. Reclamation and final closure would require 90 and 75 employees, respectively, for Alternatives D and E from 2003 to 2005, dropping to 50 and 25 in 2006. Employment duration of one year or more is considered to be permanent for purposes of this analysis. Employment duration of less than one year is considered to be temporary.

Alternative A - No Action

The potential loss of 600 direct mining jobs, and up to 750 indirect support and service sector jobs, as a consequence of closure of the Jerritt Canyon operations could result in the loss of $39.2 million per year in personal income to Elko County workers, thereby having a substantial negative effect on the local economy. Local businesses could be impacted by reduced purchases of goods and services by IMC, its employees and affected

Table 4.38
Jerritt Canyon Mine Expansion
Employment Levels By Alternative
(fiscal years)

Year	Alternative						
	A	B	C	D[1]	E[1]	F	G
1993	600	600	600	600	600	600	600
1994	600	775	775	775	775	710	840
1995	300	775	775	800	800	755	870
1996	100	660	660	685	685	755	755
1997	50	660	660	685	685	755	755
1998	50	485	485	500	500	465	565
1999	0	395	395	410	410	285	395
2000	0	395	395	410	410	110	395
2001	0	200	200	220	210	110	200
2002	0	100	100	140	125	50	100
2003	0	50	50	90	75	50	50
2004	0	50	50	90	75	50	50
2005	0	50	50	90	75	0	50
2006	0	0	0	50	25	0	0
2007	0	0	0	0	0	0	0

Source: Independence Mining Company August 1993.

Note: [1] Alternatives D and E are assumed to be economically feasible for this analysis.

indirect businesses and their employees. Unemployment rates could rise and demands on social services could increase if other employment were not locally available. The local economy would be further depressed by a decline in property values and the tax base would be eroded by reductions in revenues from property taxes and sales taxes. Community stability would be disrupted under this alternative.

Alternative B - Proposed Action & Alternative C

At an average annual wage of $38,700 (IMC 1993b), creation of 175 new mining operations jobs under these alternatives would result in a direct payroll increase of $6.8

million per annum in 1994 and 1995. The mine work force would gradually be reduced from 1996 through 2002 when operations are anticipated to cease. At the 1991 state average annual wage of $21,504 for service sector jobs (US Department of Labor 1992), another $3.0 million in wages would be paid annually to secondary or indirect service sector workers. The combined mining and service sector annual payrolls of $9.8 million would contribute to the local economy through purchases of goods and services. In addition, an estimated $2.8 million would be paid in Federal income taxes on these wages.

Alternatives D & E

The new jobs assumed to be created under these alternatives would result in a total direct payroll increase of $6.8 million in 1994, $7.7 million in 1995, and $3.3 million in 1996 and 1997. Indirect payroll increases of about $2.6 million, $3.0 million, and $1.3 million would occur for these same periods if the indirect employment opportunities specified in Table 4.36 were created.

Alternative F

The addition of 110 new mining jobs in 1994, increasing to 155 in 1995 under this alternative, would result in a direct annual payroll increase of $4.2 million in 1994 and $5.9 million in 1995 through 1997. The addition of an indirect service sector annual payroll of $2.6 million could result in a total increase of $6.8 million to $8.5 million in personal income per year for Elko County workers during this period. Mine employment levels would begin to decline gradually in 1998 until operations cease in 2001.

Alternative G

Mining operations under this alternative would require 240 additional employees in 1994, increasing to 270 additional workers in 1995. Employment would then stabilize at 755 (155 over the 1993 level of 600) for the years 1996 and 1997. Employment would then gradually decline until operations cease in 2002. The payroll increase could exceed $10 million annually during peak employment years. Wages paid to indirect service sector employees could be as much as $4.9 million annually during the 1994 to 2002 period.

Cumulative Effects

Moderate growth which is projected for the mining industry of the region would continue to stimulate the local economy in Elko County resulting in further diversification and sustainability over the next two decades. On a broader scale, the long term economic growth and diversification of the state economy through the location of firms supplying goods and services to the minerals industry would be further enhanced and the quality of the state's labor force and infrastructure would continue to be upgraded (Dobra 1989).

A total of 2,095 temporary construction jobs and 865 permanent jobs would be created in the region by the seven mining projects (other than the Jerritt Canyon Expansion)

proposed to start-up between 1993 and 1997. These new primary industry jobs would create an additional 1,403 temporary and 756 permanent service and support sector jobs in Elko County. During peak employment periods, yearly direct and indirect construction wages paid could exceed $90 million based on 1991 average construction and service sector wages for the state (US Department of Labor 1992). Yearly direct mining wages paid to new operations workers would be $31.1 million and yearly indirect wages would be $16.2 million based on 1991 average state wages. The total annual cumulative payroll associated with the seven proposed projects could be as much as $137.7 million depending on the number of construction and operations workers employed during a given year. Combined duration of these projects is estimated to be nearly two decades (1993 to 2011). As some projects come off line, employment possibilities would occur at other projects if the reasonably foreseeable operations are realized.

Housing

Historically, housing has been relatively limited throughout the county. Vacancy rates were very low prior to the resurgence of gold mining activity in the region (USDA, USFS 1980). It is likely that some units may need to be added to the available housing stock as a result of in-migrating families associated with the proposed expansion and other projects proposed to come on line in the reasonably foreseeable future. Past trends indicate that new housing construction correlates closely with market demand. It is anticipated that this trend would continue in the future. Housing costs tend to reflect market demand and it is assumed that prices would continue to rise concurrently with increased demand and would stabilize when supply is adequate to meet demand.

Temporary housing needs associated with the proposed expansion would have a negligible effect on existing supply. The cumulative demand on temporary housing (RV sites, hotels/motels, apartments) resulting from other projects could exceed available units during peak construction phases.

A summary of project-related and cumulative housing requirements associated with known proposed projects is displayed in Table 4.39. Temporary housing is considered to have a maximum of one-year occupancy for purposes of this analysis. Permanent housing is that which would be occupied for more than one year. Estimates of the types of housing which may be required are based on 1990 Census information.

Alternative A - No Action

Additional housing units would not be required in Elko county under this alternative. Property values could potentially be depressed if the Jerritt Canyon project shuts down before or during 1996 and out-migrating displaced homeowners put their homes on the market simultaneously.

Table 4.39
Housing Requirement Summary

Project-Related[1]																
	Direct					Indirect					Total Direct and Indirect					
	Temporary	Permanent				Temporary	Permanent				Temporary	Permanent				
Alternative	B, C, D, E, F & G	B & C	D & E	F	G	B, C, D, E, F & G	B & C	D & E	F	G	B, C, D, E, F & G	B & C	D & E	F	G
Housing Type[2]																
Single-family	1	44	51	40	69	1	17	19	15	26	2	61	70	55	95
Multi-family	2	17	19	15	26	1	6	7	5	10	3	23	26	20	36
Mobile Home	2	38	43	33	58	1	14	16	12	21	3	52	59	45	79
RV Site/Motel	4	0	0	0	0	3	0	0	0	0	7	0	0	0	0
TOTAL UNITS	9	99	113	88	153	6	37	42	32	57	15	136	155	120	210

CUMULATIVE[3]						
	Direct		Indirect		Total Direct and Indirect	
Housing Type	Temporary	Permanent	Temporary	Permanent	Temporary	Permanent
Single-family	64	268	41	97	105	365
Multi-family	129	103	85	33	214	136
Mobile Home	128	226	84	74	212	300
RV Site/Motel	322	0	212	0	534	0
TOTAL UNITS	643	597	422	204	1,065	801

Source: GeoResearch, Inc., 1993.

Notes:
[1] No additional housing units would be required under Alternative A. Actual housing needs would depend on the economic feasibility of Alternatives D and E, as well as the technical logistics and economic feasibility of Alternatives F and G.
[2] Estimates based on 1990 Census occupancy information.
[3] Based on best available information regarding proposed planned projects (see Table 4.33) expected to impact Elko County, excluding the proposed action.

Alternative B - Proposed Action & Alternative C

An estimated total of 15 temporary housing units could be required as a result of in-migration. An estimated total of 136 permanent units could also be required. Of these, 99 would be for mine workers and their families, and 37 would be for service and support industry workers. It is assumed that nearly all of the new direct and indirect households would settle in the Elko/Spring Creek area where existing housing availability is highest and where most new housing would likely be located.

Alternatives D & E

These alternatives could result in up to 15 temporary and 155 permanent housing units being required for new mining and service sector employees moving into the area. The new mining households would require 113 of the permanent housing units, with the remaining 42 being needed for indirect industry employees.

Alternative F

An estimated total of 15 temporary and 120 permanent housing units could be required as a result of in-migration under this alternative. New mining employees would require 88 units and indirect industry employees would require 32 units.

Alternative G

An estimated total of 15 temporary and 210 permanent units could be required under this alternative, 153 units for in-migrating mine employees, and 57 units for in-migrating indirect industry employees.

Cumulative Effects

Based on in-migration projections associated with the seven mining projects proposed in the region (not including the Jerritt Canyon Expansion), an estimated total of 1,065 temporary housing units, primarily RV sites, motel units and apartments, could be required in Elko County during the highest projected demand period expected to occur from 1993 through 1995. The actual number of units required at a given time would vary depending on timing and duration of project construction phases. All temporary units are assumed to be rentals. An estimated 801 permanent units could be required over the cumulative life (two to 15 years) of the proposed projects. Based on 1990 Census occupancy statistics, 64.5 percent of the permanent housing demand would be for homes to purchase, and 35.5 percent would be for rentals (US Bureau of the Census 1990). The need for additional housing units would not occur simultaneously, but would correspond to growth over time.

Financial Resources

Elko County is highly dependent on tax revenues received from IMC in the form of sales and use taxes, property taxes and net proceeds taxes, the county's three most

important sources of revenue (Chapman, pers. comm. May 1993). Receipts from sales and use taxes and property taxes are expected to increase upon expansion of mine facilities, purchase of new equipment and increased purchases of services and supplies. For example, purchase of new equipment, such as a haul truck, would be assessed a 6.5 percent sales tax upon purchase, and would then be added to IMC's personal property tax listing and taxed accordingly each year. From a strictly economic perspective, the local government would have a funding source if the truck were purchased. If no truck is purchased, there would be no taxes paid (Chapman, pers. comm. June 1993). Revenues received by local governments from sales, use, and property taxes are expected to increase under all Alternatives except Alternative A, under which substantial decreases in revenues would result. Potential losses of revenues from taxes paid by IMC, its employees, and by secondary businesses and their employees, could have significant negative impacts on the county's financial solvency (Chapman, pers. comm. June 1993).

Net proceeds of mines tax revenues would vary considerably as a result of differing costs of production among the alternatives. Net proceeds taxes, assessed at five percent of mining profits, are influenced by the price of gold and cost of production. Operating expenses that directly affect mining operations are deductible. Therefore, the proceeds tax is assessed against only the net mining profits. Consequently, selection of an alternative which requires costly implementation measures to produce the same amount of gold in a given year above the cost of Alternative B - Proposed Action, would erode the county's tax base significantly by reducing potential net proceeds revenues (Chapman, pers. comm. June 1993).

Analysis of impacts to net proceeds tax revenues is based on a relative comparison of estimated costs of implementing Alternatives B through G. Under Alternative A - No Action, the state and county would no longer receive net proceeds revenues from the Jerritt Canyon Mine, as operations would cease. The relative costs of implementation and impacts to net proceeds tax revenues for the action alternatives are displayed in Table 4.40. Alternative B is presented as the base level, to which the added costs of implementing the other alternatives are compared. The potential loss of net proceeds tax revenue is indicated as $0 for Alternative B, while losses presented for the other alternatives are based on reductions to taxable income resulting from added costs of implementation. (Refer to Table 4.34 for a detailed explanation of costs by alternative.) As IMC's costs of operation rise, net proceeds tax revenues to the county would decrease as indicated in Table 4.40, or cease entirely if added costs of implementation caused the project to be economically infeasible.

Public Facilities and Services

Public officials indicate they are "catching up" with the increased demand for public facilities and services resulting from rapid growth experienced in the latter half of the late 1980s. Sustained economic growth is necessary for the local governments to continue to finance ongoing capital improvement and infrastructural expansion programs, e.g. siting new landfills, transportation and roads, new schools (Boucher pers. comm. Chapman pers. comm, Lipparelli pers. comm.). At projected growth rates associated with the proposed

Table 4.40
Impacts to Net Proceeds Tax Revenues by Alternative Over the Life of the Project

Costs		Potential Reduction of Net Proceeds Tax Revenues[1] Over the Life of the Project Compared to Alternative B
Base Level[2]		
Alternative B	$ 0.00	$0.00
Added Costs[2] (in millions)		
Alternative C	$ 2.13	$106,500.00
Alternative D	$ 35.13	$1,756,500.00
Alternative E	$ 17.74	$887,500.00
Alternative F[3]	$ 0.41	$20,500.00
Alternative G	$ 0.20	$10,000.00

Source: IMC 1993 and GeoResearch, Inc. 1993.

Notes: [1] Net Proceeds tax revenues are assessed at 5% of net mining profits. Losses are calculated as 5% of added costs.
[2] Refer to Table 4.31 for detailed explanation of costs by alternative. Costs for Alternative B were assumed to be $0 as a baseline for purposes of comparison.

action, public facilities and services would continue to be adequate, with the exception of some public schools in the Elko, Spring Creek and Carlin areas which are currently near-capacity or overcrowded.

Continued growth in Elko County is not deemed by county officials to be problematic or negative in terms of additional demand for public facilities and services. Local officials are concerned that a decision which is unfavorable to the proponent, or which would delay the proposed expansion, would cause negative impacts to the county in terms of negative effects to businesses, lost jobs, wages, and tax revenues (Chapman, pers. comm. May 1993, June 1993).

A ten-year school construction plan is in place which provides for new facilities to be built and which is expected to meet demand by the year 2002. This construction is based on a pay-as-you-go financing plan which depends on continued property tax and net proceeds tax revenues from IMC and contributions from regional mining companies whose employees and their families live in Elko County (Chapman, pers. comm. May 1993). Approximately 60% of county tax receipts go to support the public school system. The county's ability to meet financial obligations incurred for the school expansion program

would be seriously jeopardized if the revenue stream generated from taxes paid by IMC and its employees, and indirect businesses and their employees, were interrupted, decreased, or no longer flowing into county coffers (Chapman, pers. comm. May 1993).

IMC's Jerritt Canyon operation is located in Elko County. Therefore, all associated property, net proceeds, and sales taxes benefit Elko County directly to compensate for the increased enrollments. This may not be the case with other proposed mining projects which are located in Lander and Eureka Counties.

Alternative A - No Action

An increase in the school-age population associated with in-migration would not occur under this alternative and the student population could decline by approximately 975 if displaced IMC employees and service sector families moved out of Elko County as a consequence of the shut-down of the Jerritt Canyon project.

This decline in student population would result in an immediate loss of approximately \$3.7 million in revenues to the Elko County School District (based on state tax distributions of \$3,800 per student). The school district would also lose federal revenues generated from payments for those dependents of wage earners working on federal lands (Chapman, pers. comm. July 1993).

Alternative B - Proposed Action & Alternative C

Based on a 1990 household average of 1.25 school-age children in public schools in Elko County (US Bureau of the Census), the total number of school-age children (K-12) is projected to increase by 179 due to in-migration under these alternatives. Of the projected permanent increase, 124 would be children of mine employees and 46 would be children of service sector employees. In-migrating permanent students would likely begin to attend Elko or Spring Creek schools beginning late 1994 and early 1995. In addition, 9 temporary students would probably be in Elko or Spring Creek schools in the fall of 1994. (Refer to Table 4.36 for summary of new school-age population).

Alternatives D & E

Approximately 203 additional new students would attend local schools if either one of these alternatives were selected. Of these students, nine would be temporary and 194 permanent. The number of permanent students from households directly employed in mining would be 141, while 53 would come from residents indirectly employed by mining.

Alternative F

There would be an influx of 160 new students under this alternative: 9 temporary; and 151 permanent, 112 direct employment-related and 48 indirect employment-related.

Place and timing of attendance would be similar to that described for Alternatives B and C.

Alternative G

There would be 271 new students associated with in-migration projections under this alternative: 9 temporary, and 262 permanent, 191 mine-related and 71 indirect employment-related. Place and timing of attendance would be similar to that described for Alternatives B, C and F.

Cumulative Effects

There could be an influx of 672 temporary school-age students into the public schools in Elko, Spring Creek and Carlin due to implementation of the seven mining related projects in the area. The greatest impacts expected during the 1993 to 1995 period when most project-related construction is scheduled. Actual numbers of temporary students would vary depending on time of year and duration of construction phases for the various proposed projects. The total cumulative number of in-migrating permanent students would be 1,029. Some of these students would arrive in Elko County with their families beginning in 1993, with others expected to arrive from 1994 to 1997 as proposed projects come on line. It is anticipated that most of the new student population would attend schools in Elko, Spring Creek and Carlin.

Transportation and Energy

Impacts to power, communications, and public transportation systems would not vary significantly among alternatives. Powerlines are expected to be installed from the existing Mine Services and Administration (MSA) complex to the mine areas. Plans showing the facilities layout and powerline routes would be included in the final POO for this project (IMC 1993a).

Existing electronic sites would be utilized for the majority of radio communications. An additional radio repeater station may be installed adjacent to the Burns Basin mine area. IMC would submit layout and development plans for housing and mounting facilities and antenna towers to the USFS for review and approval prior to installation of new electronic sites on National Forest System land (IMC 1993a).

Public transportation systems would not be adversely affected by the proposed action. Movement of over-size loads or hazardous materials on public roads would be subject to state permits. Increased traffic on Highway 225 from additional employees would be minimal due to busing.

A comparison of estimated fuel use related to projected fuel consumption by alternative is shown in Table 4.41. Energy would continue to be conserved as a consequence of busing employees from Elko to the mine site.

Table 4.41 A Comparison of Fuel Use By Alternative			
Total Fuel Consumption (MM Gallons)		Difference from Alternative B (MM Gallons)	Percent Change from Alternative B
Alternative B	161.1	0	-
Alternative C	161.4	+0.3	+0.2%
Alternative D	168.8	+7.7	+5%
Alternative E	165.7	+4.6	+3%
Alternative F	82.6	-78.5	-49%
Alternative G	243.7	+82.6	+51%

Source: IMC July 1993.

4.6 Visual Resources

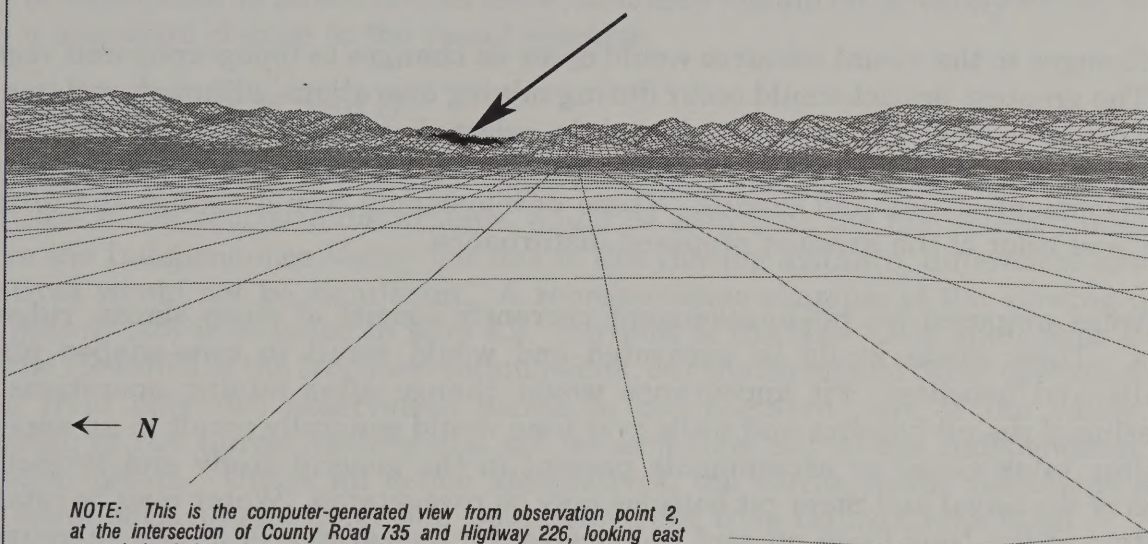
The area of analysis for direct and indirect effects are the areas seen from the Independence Valley and Project area. Cumulative effects are analyzed for areas of existing and proposed operations in the general study area. The TOCs are examined in the context of the Independence Range. Potential effects are considered over a time period coinciding with the life of the Project in the short term and after closure of all reasonable foreseeable mining and reclamation activities in the long-term. Visual resources were identified through public and agency scoping as an issue. As described in Chapter 3, portions of the Project area can be seen from a distance in the Independence Valley. Once mining operations cease, the area would be open for public recreation and changes which may not have been visible from Independence Valley would be visible from the foreground. Changes in views from a distance and within the Project area are described below.

Views from the Independence Valley were analyzed using computerized viewsheds generated with GIS data. Five locations were selected as observation points by the USFS. These locations are identified on Map 4.2. A computer program simulated the areas seen within a 360 degree radius from each of the five observation points.

Alternative A - No Action

There would be no impacts to visual resources other than those that would occur as a result of existing and approved operations. The existing visual resource conditions are

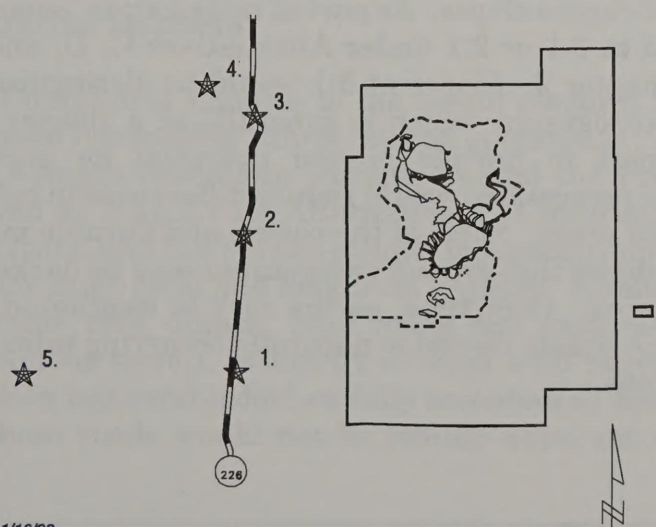
DATA SOURCE: USFS GIS data and DEM files, June 1993



NOTE: This is the computer-generated view from observation point 2, at the intersection of County Road 735 and Highway 226, looking east toward the Independence Mountain Range. It depicts existing topography, and the areas proposed for disturbance are shown as completely black areas. Saval, Steer and Burns Basin operations would not be seen from this observation point

Viewshed Observation Points:

1. Independence Valley School
2. County Road #735 Intersection
3. Intersection with Access Road to China Creek
4. Spanish Ranch
5. Tuscarora Townsite



Viewshed From Highway 226 in the Independence Valley

LEGEND

- Viewshed Observation Points
- General Study Area
- Project Area
- State Highway

No Scale - Due to Perspective View

Map 4.2

11/16/93

described in Chapter 3. Portions of existing operations can be seen from the Independence Valley. Persons travelling on Highway 226 would see portions of the area from a minimum distance of approximately five miles.

Effects Common To All Action Alternatives

The areas affected by the proposed mining activities under all action alternatives are within a USFS-designated VQO of maximum modification and implementation of an action alternative would not result in changes to that classification.

Changes to the visual resource would occur as changes to topography and vegetative cover. The greatest impact would occur during mining operations, although reclamation in the Project area would also be conducted in selected areas as existing and approved operations cease. Impacts during operations include construction of haul roads and facilities and development of pits and dumps. These developments would change the form, line, texture, and color of the areas of proposed disturbance.

Areas proposed for pit development currently consist of steep slopes, ridges, and canyons. These areas would be excavated and would result in cone-shaped pits with highwalls and benches. Pit appearance would change after mining operations cease. Weathering of the pit benches and walls over time would generally result in an appearance resembling talus slopes or escarpments present in the general study and Project areas. Portions of the Saval and Steer pit bottoms may be revegetated. Water may be retained at the bottom of the New Deep pit and would give the appearance of a lake surrounded by steep slopes under all action alternatives except Alternative F.

Waste rock dumps are proposed in canyon areas with a majority of existing slopes at angles greater than 40 percent. During operations, all waste rock dumps would be constructed by end-dumping from haul trucks, which would result in angle-of-repose slopes under all alternatives during this phase. From the Independence Valley, portions of the waste rock dumps would be visible because the line, form and color of the topography would be changed. Undisturbed slope areas would be interrupted by the horizontal line at the top of a waste rock dump or bench. Areas proposed for 3:1 slopes may have more benches than the same areas proposed for final angle-of-repose slopes. As part of reclamation, some areas of waste rock dumps would be reshaped to 3:1 or 2:1 under Alternatives C, D, and E as indicated on the Alternative Maps in Chapter 2. Slopes at 3:1 would be distinguished by their shape and line from surrounding topography which is generally at a steeper angle. The slopes at 3:1 were proposed in part to provide greater potential for successful revegetation. Areas that are successfully revegetated would reduce differences in color and texture among disturbed and undisturbed areas. Some of the coarse and durable material that would be placed on angle-of-repose slopes that are not revegetated may be darker than naturally exposed rock surfaces in the area. Over time, as the rock is weathered, these changes may become less visible and more closely resemble naturally occurring talus slopes and rock surfaces in the surrounding areas.

Portions of haul roads under any action alternative would appear as areas of cut and fill during the mining operations. Portions of haul roads would be visible from Independence Valley and would appear as changes to the form, line, and color of surrounding undisturbed areas. As part of reclamation, most roads would be completely or partially recontoured but some would remain for public access. Recontoured areas would approximate the pre-mining form and line. Recontoured and partially recontoured areas would be revegetated during reclamation and would result in texture and color that would resemble surrounding undisturbed areas.

Facilities, such as mine services areas, that may remain on privately owned land may remain a long-term change to the visual resource.

Alternatives B, C, D, E, and G

Changes to the visual resource would be similar among alternatives B, C, D, E, and G. Portions of the proposed disturbance would be seen from the five selected observation points in the Independence Valley but due to the viewing distance, differences among the alternatives would not be significant. A representative example of the viewing distance from Highway 226 is included in Map 4.2. Portions of the New Deep operations would be within the viewshed of the five observation points, but the Saval and Steer operations would be seen from only two observation points in the northern part of the valley. New disturbance in the Burns Basin would not be seen from any of the Independence Valley observation points. Under all action alternatives, the Burns Basin operations and the dumps south of Saval and Steer pits would be visible from Gance Creek Road.

Alternative F

Neither of the small dumps proposed for the New Deep operations under Alternative F would be visible from any of the five observation points. With the exception of the portions of the Saval and Steer operations that could be viewed from Spanish Ranch and China Creek Intersection observation points, portions of the haul roads associated with the underground operations would be the only disturbance within the viewshed under this alternative.

Cumulative Impacts

Cumulative impacts to the visual resource include impacts from past, existing and reasonable foreseeable future mining operations. The area of cumulative impacts from the Jerritt Canyon operations extends beyond the Project area and includes the disturbance displayed on Map 2.1 for Alternative A. Cumulative impacts include changes to the form, line, texture, and color of pre-mining topography and ground cover similar to those described above for short term and long term impacts. Cumulative impacts include disturbance from pits, waste rock dumps, haul roads and exploration roads in an area characterized by mountainous terrain primarily covered with sagebrush and grass prior to mining. Once vegetation has established on fully recontoured roads, cumulative long term visual impacts from those roads would not be readily apparent to the casual observer. Visual impacts

associated with cumulative impacts for pits, waste rock dumps, facilities and partially recontoured roads would be similar to those described for the action alternatives but would encompass a larger area.

Portions of existing, approved, and proposed mining operations would be visible from the Independence Valley as described above. Once public access is reopened, post-mining changes would be viewed from the foreground. More of the disturbance would be visible from within the Project area, so that those alternatives with a greater disturbance area would result in a greater area of impact to the visual resource. Alternative F, the underground mining alternative, would result in the least amount of disturbance. Of the surface mining alternatives, Alternative B would result in the least amount of disturbance and Alternative D would result in the greatest area of disturbance.

The TOC for visuals defined by the CEA is any change in retention and partial retention VQO Classes in the Independence Mountain Range. The area of cumulative impacts from the Jerritt Canyon mine operations is entirely within an area classified by the USFS as a maximum modification VQO. The cumulative changes could occur and still meet the USFS VQO criteria for maximum modification.

4.7 Cultural Resources

The area of analysis for impacts to cultural resources is the general study area. As defined by the CEA Technical Guide, the TOC for cultural resources is any unauthorized damage in the short-term and/or loss of 20 percent of the sites eligible for the National Register of Historic Places (NRHP) in the long-term. Short-term effects are those that would generally not last longer than the life of the Project. Long-term effects are those that continue after closure and reclamation. The TOC for Native American Religious Sites is any projected impact that is a concern to the Native American population.

Direct and Indirect Impacts

For purposes of this analysis, direct impacts are considered to be any disturbance of sites that are NRHP eligible or that have religious value to the Native American population. Under all alternatives, previously unidentified cultural resources discovered during operations would be avoided and/or activities which could damage the resource would cease. On-site mitigation measures for previously unidentified sites would be conducted in consultation with the USFS and the State Historic Preservation Office (SHPO).

Indirect impacts can include damage caused by activity outside of the projected disturbance area. Mitigation common to all alternatives includes the restriction of heavy equipment to roads and operational areas developed pursuant to the final POO. On past operations, the Mountain City Ranger District has specified buffer zones of varying distances around identified sites eligible for the NHRP as an additional mitigation for indirect effects. A 300 foot buffer zone was used for analyzing potential impacts of alternatives in this FEIS.

Additional indirect impacts include the potential for increased access for unauthorized collection of cultural resources once mining has ceased and public access is reopened.

Alternative A

Under Alternative A, any impacts to cultural resources would be those that have already been identified and approved for existing operations. In order to avoid damage to unidentified sites, IMC contributes funds for the Humboldt National Forest Service to inventory and evaluate areas before they are developed. (IMC and USDA Forest Service, Collection Agreement 1993).

Effects Common to All Action Alternatives

There are no sites identified as significant or unevaluated that would fall within the proposed disturbance of any of the action alternatives. There are no additional identified significant or unevaluated sites that fall within a 300 foot buffer zone. Consultations with descendants of the Tosawihi indicate there would be no direct or indirect impacts on the Native American traditional sacred areas under these alternatives.

Cumulative Impacts

Cumulative impacts for the existing and proposed operations are not significant within the definition of the CEA model. There has been no unauthorized damage of sites. Of a total of 11 identified significant sites in the general study area, none has been disturbed as a result of existing mine operations or would be disturbed during the proposed expansion under any alternative.

Chapter 5

List of Preparers

Photo Description: Burns Basin haul road system (Fall 1991).

CHAPTER 5
LIST OF PREPARERS

5.0 LIST OF PREPARERS

5.1 Introduction

This FEIS has been prepared by GeoResearch, a third-party consultant. GeoResearch has responsibility for completion of the FEIS under the direction of the Forest Service. Representatives from the cooperating and participating agencies have contributed to and participated in the NEPA process. Technical input regarding the proposed Project has been provided by IMC. Additional technical information regarding specific components of the proposed Project has been provided by USFS and consultants under contract to GeoResearch and IMC. The following sections present the names of individuals and their area(s) of responsibility from the Forest Service, cooperating agencies, GeoResearch, IMC, and associated consultants that have been involved in the preparation of portions of the FEIS and support documents. Brief biographical information is provided for some individuals where appropriate.

5.2 USDA - Forest Service

Key Team Members

NAME	CONTRIBUTION	DEGREE/YEARS OF EXPERIENCE
Donald Carpenter	Project Coordinator	B.S. Forest Management 23
Steve Anderson	Biological Environment	B.S. Wildlife Resources 16
Chris Butler	Surface and Ground Water Air Quality	B.S.,M.S. Watershed Sciences A.A. Forestry 12
Mary Beth Marks	Soils, Geology, Reclamation, Geochemistry, Economics	B.S. Geology 12
Jed Parkinson	Transportation, Mine Engineering	B.S. Civil & Environmental Engineering 14

Interdisciplinary and Support Team Members

NAME	CONTRIBUTION
Ben Albrechtsen	Mine Reclamation
Tom Buchta	Soils
Jack Carlson	District Ranger, Mountain City Ranger District
Doug Clarke	Land Use, Mine Reclamation
Gene Farmer	Mine Reclamation, Geochemistry
Fred Frampton	Cultural Resources
Jeff Gabardi	Mine Engineering
Roger Johnson	Cultural Resources
Dean Morgan	Land Use, Reclamation
Chrys Olson	Range, Vegetation
Gary Schaffran	Recreation, Land Use, Visuals
Irene Smith	GIS Support Services
Jon Warder	Wildlife, Fisheries, Threatened and Endangered Species
Karla Warder	Range, Vegetation
Bonnie Whalen	GIS Support Services

5.3 Cooperating/Participating Agencies

NAME	AGENCY	CONTRIBUTION
Terri Knutson	BLM	Environmental Resources
Kevin Roukey	Corps	Wetlands
Llee Chapman	Elko County	Socioeconomics
Rory Lamp	NDOW	Wildlife
Russ Fields	NDOM	Mineral Resources
Jeannie Geselbracht	EPA	Environmental Resources
MaryJo Elpers	USFWS	Wildlife, Wetlands, TES
Douglas Zimmerman	NDEP	Environmental Resources

5.4 GeoResearch, Inc.

NAME	CONTRIBUTION	DEGREE/YEARS OF EXPERIENCE
Anne Cossitt	Project Manager Cultural Resources Recreation Transportation Land Use/Access	M.A. Public Affairs 12
Mary Blackwood	GPS/GIS Support Services	B.S. Earth Science/Geography 4
William H. Bucher	Surface Water Resources	B.S. Engineering Physics 23
Curt Coover	Soils Surface Water Resources	B.A. Geology 9
Valerie Counts	Socioeconomics	B.S. Geography 5
Jere Paul Folgert	GPS/GIS Support Services	B.S. Cartography 10
Dwayne H. Jelinek	Socioeconomics	B.A. M.B.A. 29
Thomas Graves Lyman, Jr.	GPS/GIS Support Services	M.Ed. 25
Michael G. Machler	Climatology/Air Quality	B.S. Meteorology 22
Thad Mauney, Ph.D	GPS/GIS Support Services	B.S. Chemistry Ph.D. Analytical Chemistry 19
Jim McInerney	GPS/GIS Support Services	B.S. Meteorology (Chemistry) M.S. Computer Science 16
Douglas B. Richardson, Ph.D.	Project Management GPS/GIS Support Services Soils/Geology	B.S. General Studies Ph.D. Geography 16

NAME	CONTRIBUTION	DEGREE/YEARS OF EXPERIENCE
Peter Sawyer	Vegetation/Range	B.S. Geography M.S. Silviculture 15
Cynthia L. Tolle	GPS/GIS Support Services	B.S. Biology M.S. Microbial Ecology 14
Scott Wanstedt	GIS Support Service	B.S. Range Sciences 7
Theresa Whistler	GPS/GIS Support Services	B.A., M.A. Geography 6
Theodore J. Wirth	Visual Quality	B.S. Landscape Architecture 43

5.5 IMC

NAME	CONTRIBUTION	DEGREE/YEARS OF EXPERIENCE
Julia Bosma-Douglas	Project Coordinator	B.S., M.S. Geological Sciences 9
Scott Lewis	Project Manager	B.S. Range Management 10
Judy Bertuca	Mine Engineering	B.S. Mine Engineering 10
Matt Thiel, PE	Mine Engineering, Economics	B.S. Mine Engineering 18

5.6 Other Consultants

NAME	CONTRIBUTION
Westec Reno, Nevada Catherine Clark Mary E. Coburn, J.D. Daniel J. Davis Timothy M. Dyhr John O. Heggeness Michael Henderson Patricia K. Johnston Lynda Nelson Carol Oberholtzer Kara Pack William J. Reich Joan A. Reynolds Barbara L. Seeger Meg Macdonald	Groundwater, Geology, Paleontology, Vegetation, Livestock Grazing, Wildlife and TES.
Michael S. Smith, P.E. Kennedy/Jenks Consultants Reno, Nevada	Mine Engineering
JBR Consultants Group Reno, Nevada Patricia Johnston Susan Fox J. Kent McAdoo	TES
Thomas Skordal Gibson & Skordal Sacramento, California	Wetlands
Kent Crofts IME Yampa, Colorado	Wetlands
HCI Hydrologic Consultants Lakewood, Colorado Tom Hanna Lee Adkinson	Groundwater, Hydrology
Howard Eriksen Condor Earth Technologies Sonora, California	Surface Water

NAME	CONTRIBUTION
Dr. William Schafer Schafer and Associates Bozeman, Montana	Geochemistry
Call & Nicholas, Inc. Tucson, Arizona	Mine Engineering
Knight Piesold and Co. Denver, Colorado	Mine Engineering

Chapter 6

List of Agencies, Organizations and Persons to Whom Copies of this Statement were Sent and DEIS Comments and Responses

Photo Description: Looking west from existing operations to the existing West Generator pit and proposed New Deep Pit area. Tuscarora Mountains are in the background. (Fall 1992).

CHAPTER 6

LIST OF AGENCIES, ORGANIZATIONS AND PERSONS TO WHOM COPIES OF THIS STATEMENT WERE SENT AND DEIS COMMENTS AND RESPONSES

6.0 LIST OF AGENCIES, ORGANIZATIONS AND PERSONS TO WHOM COPIES OF THIS STATEMENT WERE SENT AND DEIS COMMENTS AND RESPONSES

6.1 Introduction

This chapter includes the written comments on the DEIS, responses to those comments, and circulation lists of federal, state, and local government agencies, organizations, and interested individuals receiving copies of the FEIS. This is not a comprehensive list since requests for copies continue. Copies of the FEIS and ROD are available for review at the Mountain City Ranger District Office in Mountain City, Nevada, the Humboldt National Forest Supervisor's Office in Elko, Nevada, and the Elko County Public Library in Elko, Nevada.

Twenty-seven letters with comments on the DEIS were received by the USFS. Seven of these letters were received after the comment period ended on January 18, 1994. All twenty-seven letters are included in this chapter. Responses to substantive comments are provided adjacent to the letters that were received within the comment period. All comments were reviewed and considered.

6.2 List of Agencies, Organizations and Persons to Whom Copies of the FEIS were Sent

Federal Agencies

Advisory Council on Historic Preservation, Washington, DC
Animal & Plant Health Inspection Service, Hyattsville, MD
Equal Employment Opportunity Commission, Washington, DC
Federal Aviation Administration, Hawthorne, CA
Federal Energy Regulatory Commission, Washington, DC
Federal Highway Administration, San Francisco, CA
Federal Railroad Administration, Washington, DC
General Services Administration, Washington, DC
Interstate Commerce Commission, Washington, DC
National Marine Fisheries Service, Portland, OR
Rural Development Administration, Klamath Falls, OR

U. S. Army Corps of Engineers, Sacramento, CA
U. S. Coast Guard - Environmental Impact Branch, Washington, DC
USDA - Forest Service, Environmental Coordination, Washington, DC
USDA - Forest Service, Intermountain Region, Ogden, UT
USDA - National Agricultural Library, Beltsville, MD
USDA - OPA Publications Stockroom, Washington, DC
USDA - Soil Conservation Service, Washington, DC
U. S. Department of Energy, Washington, DC
U. S. Department of Housing and Urban Development, San Francisco, CA
USDI - BLM Elko District Office, Elko, NV
USDI - BLM Ely Area Office, Ely, NV
USDI - Fish and Wildlife Service, Reno, NV
USDI - Office of Environmental Affairs, Washington, DC
USDI - Office of Policy Analysis, Washington, DC
U. S. Department of Transportation, Washington, DC
U. S. Environmental Protection Agency, Washington, DC
U. S. Environmental Protection Agency, San Francisco, CA.

State Agencies

Nevada Bureau of Mines & Geology, Reno, NV
Nevada Division of Minerals, Carson City, NV
Nevada Division of Environmental Protection, Carson City, NV
Nevada Division of Wildlife, Elko, NV
Nevada State Clearing House, Carson City, NV
North East Nevada Development Agency, Elko, NV
Senator Richard Bryan, Washington, DC
Senator Harry Reid, Washington, DC
Representative Barbara Vucanovich, Washington, DC
State Senator Dean Rhoads, Tuscarora, NV
Assemblyman John Carpenter, Elko, NV

Local Agencies

City of Carlin, Carlin, NV
City of Elko, Elko, NV
Elko County Federal Land Use Planning Commission, Elko, NV
Elko County Commissioners, Elko, NV
Elko County Library, Elko, NV
Elko County School District, Elko, NV

Organizations

Amax
Anderson, Pearl, Hardesty, Lyle, Murphy and Stone
Cashman Equipment

Citizen Alert-Native American Program
Colorado State University
Eklund Drilling Co.
El Tejon Sheep Company
Elko Chamber of Commerce
Elko Farm Bureau
Elko Daily Free Press
Ellison Ranching Co.
Environmental Strategies, Inc.
Greystone
High County News
Homestake Mining Company
Independence Mining Company Inc.
Intermountain Research
James J. Wright Ranches, Inc.
Komatsu Dresser - Haulpak Division
Knight Peisold and Co.
LASER
Mineral Policy Center
Monitor Geochemical Lab. Inc.
Morrison-Maierle Environmental
National Wildlife Federation
Nevada Cattlemen's Association
Nevada Mining Association
Nevada Waterfowl Association
Nevada Wildlife Federation
Nevada Woolgrowers Association
Newmont Gold Company
Northfork Cattle Company
Parsons Behle & Latimer
Pioneer Equipment
Poudre Environmental Consultants, Inc.
Santa Fe Pacific Minerals Corp
Saval Ranching Company
Shoshone-Paiute Tribes
Sierra Chemical Co.
Sierra Club, Toiyabe Chapter
Sierra Pacific Power Company
Smith DDA
Suburban Propane & Petrolane
Summitt Engineering Corporation
Taylor Canyon Resort
Te-Moak Tribe of Western Shoshone
Turner's Jewelry & Gifts
Tuscarora Branch Library
Van Norman Ranches

Westec
Western Shoshone Historic Preservation Society
The Wilderness Society

Individuals

Russell Alen
Tim Arnold
Brent Anderson
Colleen Bathker
Tim Bilbao
John W. Catledge
Mr. Llee Chapman
Mary Coburn
Charles Condrat
James Connelly
Denise Connow
Mr. Ronald Crouse
Lesley T. Cusick
Jack Daeman
Mark Endrizzi
Tom Gallagher
May Gardner
Mr. John Geddie
Steven Gibaldi
Paula Del Giudice
Royce L. Hackworth
John and Renee Jackson
David P. Jones
Martin Jones
Linda Kantor
Mr. & Mrs. Cecil L. Kinard
Donald J. King
Lewis Knight
Dan Lunsford
Craig McCaa
Robert & Bonnie Mochizuki
Nelo Mori
Pierre Mousset-Jones
John Mudge
Thomas Muth
Jim Nyenhuis
Ross Oliver
Richard M. Perry
Kenneth Puchlik
David Russell
Bob Russman
Val Sawyer
Marjorie Sill
Frank Smith
Mike and Ruth Smith
Dr. Roger C. Steininger
Robert Stuart
Ed Sutich
Larry Sutter
William Van Norman
Harry E. Wilson
Jay Wright
Robert R. Wright
Cynthia B. Wood
Mr. Stanley Zunino

6.3 DEIS Comments and Responses

Written comments on the DEIS are included in the following order:

Letter 1. Ron Crouse
Letter 2. Elko Chamber of Commerce
Letter 3. Robert Wright Ranches
Letter 4. Julie Parks
Letter 5. BLM

Letter 6. NENDA
Letter 7. IMC
Letter 8. Petan Company of Nevada
Letter 9. Sierra Club
Letter 10. Nelo Mori
Letter 11. US EPA
Letter 12. Jim Connelly
Letter 13. Elko Board of County Commissioners
Letter 14. NDOW
Letter 15. Jay Wright
Letter 16. James Wright
Letter 17. Anderson, Pearl, Hardesty, Lyle, Murphy and Stone
Letter 18. Summitt Engineering
Letter 19. Glynis Wright
Letter 20. National Wildlife Federation
Letter 21. Nevada State Clearinghouse (received after deadline)
Letter 22. Renee Jackson
Letter 23. Nevada Department of Conservation and Natural Resources - Division of Water Resources (received after deadline)
Letter 24. Mark Endrizzi (received after deadline)
Letter 25. Lesley T. Cusick (received after deadline)
Letter 26. NDEP (received after deadline)
Letter 27. US Department of the Interior (received after deadline)

Letter #1

Ronald L. Crouse
652 E. Abarr Dr.
Elko, Nv. 89801

December 27, 1993

Mr. John Inman, Forest Supervisor
Humboldt National Forest
976 Mountain City Highway
Elko, NV. 89801

1 Concerning the Jerritt Canyon Mine Expansion Draft EIS: I will limit my comments to the investigation of potential for acid mine drainage. I believe the investigation, as presented in the DEIS, to be inadequate. A much more detailed study should be completed, including development of a mitigation plan, before the final EIS is released.

Any investigation into acid mine drainage (AMD) potential of a mineral deposit should be a two-part investigation into: 1) background geochemistry of mined overburden, and 2) geochemistry of mineralized rock. The DEIS investigation appears to have satisfied the first, but not the second of these.

The DEIS description of ore processing (page 2-3) describes use of chlorination and roasting. These processes imply the presence of carbonaceous and/or sulfidic ore. Yet the acid-base accounting results that are presented (page 3-5), indicating low acid generating potential for most waste rock, appear to be accepted as valid for all waste rock. The DEIS correctly states, however, that evaluations based on average or weighted average NP/AP ratios for specific rock types may be misleading (page 3-7).

2 The final EIS should include a section on detailed geology of each of the deposits, including type sections with contours of 1) gold mineralization, 2) gold ore boundaries at mill process cutoffs, 3) neutralization potential (NP) values, 4) acidification potential (AP) values, and 5) NP/AP ratio values. The result will probably show that, while most of the waste has high NP/AP ratios, a small, yet significant volume of low grade mineralization will have low NP/AP ratios. It is this small volume of material that would cause the majority of any future AMD problems.

Ore deposits generally have the same mineralogy regardless of grade. If most of the ore is refractory, there is a high probability that low-grade mineralization (i.e. waste) will have the same mineralogy. Therefore, any sulfidic waste adjacent to ore should identified and modeled so that an AMD mitigaton plan can be developed for that material.

Sincerely,

Ronald L. Crouse

Ronald L. Crouse

Letter #1
Ron Crouse

Response 1

We acknowledge your concern for acid rock drainage (ARD) potential. Static testing to determine the acid generating potential was performed for the DEIS. Additional studies were completed after issuance of the DEIS using kinetic testing procedures. A summary of kinetic test results are included in the FEIS (see the Geochemistry Portion of Section 3.2.). Representative samples for static testing were taken from the rock types to be mined, including both overburden and mineralized rock. The worst 5 to 10 percent of the samples from an acid base accounting perspective were then subjected to kinetic testing. An overview of the waste rock sampling and handling plan that discusses the handling and placement of potentially acid generating material within the waste rock dumps has been completed and included in Appendix A.

Response 2

Gold mineralization and gold ore boundaries at mill process cutoffs are proprietary information held by IMC and will not be displayed in the FEIS.

A summary of acid-base accounting results is shown in Table 3.1 and discussed in the Geochemistry portion of Sections 3.2 and 4.2 of the EIS.

Letter #2

THE BEST SMALL TOWN IN AMERICA Elko NEVADA *YES!*

CHAMBER OF COMMERCE

Ranger District

JAN 06 '94

DR
SUPV ANGY
MINERALS
E.A. COORD
WL BIO
FORESTER
RANGE TECH
FOR TECH
S.S.S
TYPIST

January 3, 1994

Mr. Don Carpenter
Mountain City Ranger District
P.O. Box 276
Mountain City, NV 89831

Dear Mr. Carpenter:

The Board of Directors for the Elko Chamber of Commerce has received a copy of the Jerritt Canyon Mine Expansion Draft Environmental Impact Statement. As an organization created to represent, support and stimulate local businesses, we offer the following comments on the Draft document.

The description of the socioeconomic environment in the Draft is very comprehensive in nature and recognizes the importance of Independence Mining to the community, county, and state. This document correctly identifies Independence Mining as the single largest property tax payer in Elko County. Independence Mining is accurately described as paying a substantial amount in net proceeds taxes and sales and use taxes. In addition, the document appropriately indicates that Independence is a major employer and purchaser of goods and services. The donations made by Independence to various organizations and institutions are also acknowledged in the Draft document.

Considering the importance of Independence Mining Company to the continued vitality of the local economy, we feel that it is imperative for the Forest Service to approve an alternative that provides a balance between economic viability and environmental protection. The identification of Alternative C as the Forest Service preferred alternative appears to achieve this balance. The Elko Chamber of Commerce supports the selection of Alternative C as it is described in the Draft.

The Draft document implies that timing is crucial to this project. We urge the Forest Service to approve the mine expansion in a timely fashion. This will help ensure that the economic prosperity and growth being realized in Elko continues into the future.

Sincerely,

Lorri Kocinski

Lorri Kocinski
Director, Elko Chamber of Commerce

1601 Idaho Street • Elko, Nevada 89801 • (702) 738-7135

Letter #2
Elko Chamber of Commerce

Thank you for your letter. Comments noted.

Letter #3

HC 60 Box 120
Clover Valley,
Wells, Nev. 89835
Jan. 10, 1994

Jack M. Carlson
District Ranger, U.S.F.S.
P.O.Box 276
Mountain City, Nevada 89831

Dear Mr. Carlson;

In reviewing the Draft Environmental Impact Statement for the Jerritt Canyon Mine Expansion I find that there hasn't been any provision for the replacement of Livestock forage that is to be lost because of the expansion.

1 It is interesting to note that funding ($500,000) is being made available to N.D.O.W. for range betterment of deer areas. But No firm committments have been made for the loss of livestock grazing. This is discriminatory and should be resolved to everyone's satisfaction at an early date.

2 With the magnitude of the project watershed protection must receive a high priority. Streams flowing out of the area will undoubtedly have some sedimentation flow. This would not be acceptable.

The ranching industry has been and will always be an important part of Elko County. It is important to maintain this stable and reliable industry. It is also important to maintain a good relationship between all the parties concerned with the expansion project.

Sincerely,
Robert R. Wright
Robert R. Wright Co.
Robert R. Wright, Pres.

Letter #3
Robert Wright Ranches

Response 1

Grazing permits on national forest lands are privileges that are revocable by the USFS without compensation. The EIS discloses potential impacts from the projected loss of livestock forage areas. Partial mitigation of potential impacts may sometimes occur through the reallocation of grazing resources on other allotments. It is Humboldt National Forest policy that grazing permittees who have had their grazing permits canceled because of mining operations or other reasons will retain "preferred applicant" status for forage available for reallocation under the grant process until the expiration date shown on the permit or five years, whichever is greater.

A 50 percent reduction in animal months identified in the DEIS on the Jerritt Creek allotment does not equate to a 50 percent reduction on all animal months held by the allotment permittee. The allotment was evaluated for the FEIS and it was determined that there would actually be a 63 percent reduction in animal months for Alternatives B, C, D, E, and G. By building additional fences in the Project area, there would be a 29 percent reduction for Alternative F. The permittee also holds grazing licenses and permits on surrounding federal lands, both BLM and USFS.

The reduction in animal months may not be permanent. Once reclamation and revegetation have occurred, the USFS will assess the allotment for re-instatement of livestock grazing.

Response 2

We anticipated that mining activities would generate some sediment. As such, we have developed mitigation measures which include following the applicable concepts in Nevada's "Handbook of Best Management Practices." Specific mitigation measures for sediment control include installation of engineered sediment dams and ponds, check dams, silt fence, riprap, erosion control fabric, vegetative sediment filters and other effective methods. It is anticipated that these measures would ensure compliance with state water quality regulations.

Letter #4

PO Box 7
Tuscarora, Nevada 89834
January 13, 1994

Don Carpenter
Humboldt National Forest
Mountain City Ranger District
PO Box 276
Mountain City, Nevada 89831

Dear Mr. Caprenter:

I am writing to protest the Jerritt Canyon Mine Expansion. On January 6, 1994, I attended the discussion of the mine expansion draft environmental impact statement that was held at the Independence Valley School. My concerns over the threat to Independence Valley's water sources were only heightened. The Van Norman Spring has already experienced contamination during this past year. Burns Creek did not flow during this very wet summer despite the mining company's waste rock configuration which was supposed to assure continued flow underneath. I fear that matters will only be worse in Jerritt Canyon. Forest Service and Independence Mining Company representatives agreed that there can be no assurance that the Niagara Spring will not be affected by the new mining activity. Basically they said, "We don't know what will happen underground." I do not feel that the Jerritt Canyon Mine Expansion warrants taking this risk. The residents of Tuscarora have an inherent interest in the springs on the west side of the Independence Range, for they have been the only source of water hauled to our community during drought years.

Sincerely yours,

Julie Parks

Julie Parks

Letter #4
Julie Parks

Response 1

Based on our analysis, the maximum potential impact to the Independence Valley from existing and proposed mining would range from a decrease of 540 acre feet under Alternative F to a decrease of 950 acre feet under Alternative E. This represents a 1 percent to 2 percent decrease in the total water which flows through the USGS gauge located on the South Fork of the Owyhee River near Spanish Ranch. Moreover, it is likely that surface water quantity would be less than 950 acre feet/year because precipitation intercepted by pits will enter the groundwater system and discharge to downgradient springs and streams.

A report prepared by Hydrological Consultants, Inc. concluded as follows: "The historical evidence indicates that discharges from Van Norman Spring produced turbid water before any mining activities took place in the Jerritt Canyon area. It is reasonable, given the wet weather in the Spring of 1993, that the turbidity is a result of natural processes."

Letter #5

United States Department of the Interior

TAKE PRIDE IN AMERICA

BUREAU OF LAND MANAGEMENT
ELKO DISTRICT OFFICE
3900 E. IDAHO STREET
P.O. BOX 831
ELKO, NEVADA 89801

IN REPLY REFER TO:
3809 (NV-014)
N16-81-07P

Mr. John Inman, Forest Supervisor
Humboldt National Forest
976 Mountain City Highway
Elko, NV 89801

Dear Mr. Inman:

The Elko District Bureau of Land Management, as a cooperating agency, has been actively involved in the development of the Jerritt Canyon Mine Expansion Draft Environmental Impact Statement now under review. Most of the comments and concerns from this office have been incorporated into the draft document, as a result of previous internal administrative reviews.

The Elko District offers the following:

1

1. Map 1.3 showing land ownership does not show land status of mill facilities on BLM and private lands, although the text on page 1-7 says "The Jerritt Canyon operations are divided into two separate geographic components, one for mining and one for processing".

2

2. Page 2-4, Paragraph discussing tailings facilities need to add the following at the end: "This DEIS evaluates the proposed mining operations that would require the additional 20 million ton capacity. Authorization for the additional capacity would be made, as appropriate, by the BLM after approval of the proposed mine expansion." It may also need to be footnoted here that the Decision Record for the new tailings facilities is currently under appeal.

3

3. Mitigation, especially for deer and sage grouse, is primarily offsite. For deer, the mitigation seems inappropriate - the impact is to the winter range in the Independence Mountains and mitigation is in the Sheep Creek and Izzenhood Ranges. The subpopulation impacted will not receive any benefit from these rehabilitation projects. Opportunities for mitigation for this herd need to be looked for within the immediate vicinity of the impacted area before going offsite.

4

4. Cumulative impacts for all resources should include the proposed action and alternatives and any "reasonably foreseeable future actions", not just the past and present. This is especially pertinent to the sections on wildlife, livestock grazing, water resources (surface, subsurface, wetlands), and visual resources. Cumulative impacts sections also need to address timeframes and area of impacts analyzed for specific resource.

Thank you for the opportunity to provide comment on this project. If you or your staff have any questions, please contact Terri Knutson at (702) 753-0200.

Sincerely yours,

Rodney Harris

RODNEY HARRIS
District Manager

Letter #5
BLM

Response 1

Comment noted and Map 1.3 has been revised accordingly.

Response 2

Comment noted and the narrative on page 2-4 has been revised accordingly. The appeal on the new tailings pond was dismissed by the Department of Interior's Board of Land Appeals on February 8, 1994.

Response 3

During the development of the Mule Deer MOU opportunities for the Project area and off-site mitigation within the Independence Mountain Range were looked for, but suitable projects were not identified in this area. It was agreed upon by NDOW and the USFS that mitigation projects could be conducted within the boundaries of Deer Management Area 6. See Appendix E for the Mule Deer MOU Mitigation Plan. Suitable on-site mitigation projects for sage grouse were looked for, but were not available in the Project area. Due to large fires on the east side of the Independence Mountains in the general study area, an off-site mitigation project was identified in cooperation with the BLM and NDOW and scheduled for treatment.

Response 4

The alternatives presented in the EIS represent the reasonably foreseeable future action (see Section 2.4 for the "Alternatives Considered for Detailed Study" discussion of the proposed action and EIS analysis area). Cumulative impacts were addressed for these alternatives utilizing the CEA computer model. As indicated on page 2-12 of the DEIS and on page 2-8 of the FEIS, the analysis is based on the disturbance that might occur in the reasonably foreseeable future if gold prices were to increase over current levels.

Letter #6

NENDA
North East Nevada Development Authority

"Promoting Economic Development and Diversification Throughout Elko County"

RESOLUTION 94-2

Representing:

City of Carlin

City of Elko

County of Elko

City of Wells

City of West Wendover

Whereas, the North East Nevada Development Authority is the economic development agency promoting the economic development, diversification, and stability of Elko County, and

Whereas, Independence Mining Company is the largest taxpayer in Elko County, and

Whereas, Independence Mining Company employs an average of 650 Elko County residents, and

Whereas, there is one job (Conservatively Estimated) tied to each mining job, and

Whereas, the proposed expansion of Independence Mining Company will add seven years to the life of the mine, and

Whereas, Alternative C, as proposed by the U.S. Forest Service, is a reasonable approach that addresses environmental, economic, and community needs,

Now Therefore Be It Resolved, the North East Nevada Development Authority supports Alternative C as proposed by the U.S. Forest Service.

Deborah M. Smith — January 18, 1994

Deborah M. Smith
Executive Director

Date

P.O. Box 2812 • Elko, Nevada 89801 • (702) 738-2100 • FAX (702) 738-7978

Letter #6
NENDA

Thank you for your letter. Comments noted.

Letter #7

INDEPENDENCE
MINING CO. INC.

HC 31 BOX 78
ELKO, NEVADA 89801
TELEPHONE: 702-758-9221
FAX: 702-758-9231

January 18, 1994

Mr. Jack Carlson
U.S. Forest Service
Mountain City Ranger District
P.O. Box 276
Mountain City, NV 89831

Re: Comments on the Draft Jerritt Canyon Mine Expansion Environmental Impact Statement

Dear Mr. Carlson:

Independence Mining Company Inc. (IMC) hereby submits the following comments on the Draft Environmental Impact Statement (DEIS) for the Jerritt Canyon Mine Expansion Project. The DEIS was issued by the U.S. Forest Service on December 3, 1993.

IMC believes that the DEIS, in general, contains a comprehensive evaluation of the potential effects of the proposed action and the alternatives on the physical, biological, social and economic environment of the Project area. The seven alternatives presented in the DEIS represent a full range of alternatives that respond to the issues and concerns raised during the scoping process. However, several aspects of the DEIS require further discussion or clarification.

1. ALTERNATIVES ANALYSIS

1 The Forest Service has selected Alternative C as the preferred alternative for the DEIS. IMC recognizes the environmental benefits and supports the selection of Alternative C as it is displayed and described in the DEIS. The Forest Service should carefully consider the economic and social impacts of any additional restrictions or requirements on the Alternative C waste rock dumps, haul roads, stockpiles, and facilities/structures.

We also believe Chapter 2 of the DEIS should fully disclose that Alternatives D and E are not considered economically feasible to implement by IMC. After a thorough analysis by IMC's engineers, we have concluded that the selection of Alternative D or E would likely result in premature closure of the Jerritt Canyon operations at current and reasonably foreseeable gold prices. It should also be disclosed that Alternative D results in adverse environmental

Letter #7
IMC

Response 1

Comments noted: All alternatives are assumed to be economically feasible to implement for analysis purposes throughout this FEIS.

2 impacts in terms of increased disturbances of waters of the U.S., wetlands, vegetation, wildlife habitat (particularly aspen habitat), and other resources relative to the other action alternatives. These effects are the result of creation of waste rock dumps with slopes of 3H:1V and the additional haulroads required to develop dumps with 3H:1V slopes. Creation of dump slopes at this shallow angle is considered inappropriate at many locations within the Jerritt Canyon Mine Expansion area because of the steep natural terrain, arid climate, and low density of natural vegetation. In this environment, angle of repose slopes with coarse and durable rock armoring can be expected to produce greater surface stability than 3:1 slopes covered with growth medium. Developing the waste rock dumps with angle of repose slopes also increases the area of relatively flat dump surfaces, which have a higher revegetation potential than 3H:1V slopes. The EIS should inform the reader of the adverse environmental and socioeconomic impacts associated with Alternatives D and E.

Finally, selection of an underground alternative depends upon the economic and technical feasibility of mining the New Deep deposit by underground methods, which IMC is currently in the process of evaluating. It should continue to be made clear that any alternative, including an underground mining alternative (Alternative F or G), cannot be selected without considering the technical and economic feasibility of such an alternative.

2. DEIS EVALUATION OF EFFECTS ON LIVESTOCK GRAZING

3 The DEIS states (page 4-69) that under any of the action alternatives, a closure of one unit would be anticipated for the Jerritt Creek Cattle and Horse Allotment, representing a 50 percent reduction of AUMs from 750 to 375. The DEIS also states that the short term cumulative impact to forage resources would vary from 20 to 31 percent and all action alternatives would exceed the threshold of concern (TOC) of 20 percent. IMC questions why the disturbance of approximately 27 percent of the high to moderate value forage in the Jerritt Creek Allotment would result in a 50 percent reduction in AUMs. Reduction in AUMs should be closely tied to the degree of actual impacts to areas with high to moderate forage value for livestock. Using this approach, a short-term disturbance of approximately 27 percent and a long-term disturbance of about 9 percent of high to moderate resource value forage areas would occur under Alternative C.

As discussed in Chapter 2 of the DEIS, the projected disturbance for each of the alternatives displayed in the DEIS is greater than that which would likely occur on the ground in the reasonably foreseeable future. Actual disturbance would likely be on the order of two-thirds or less of the disturbance acreages analyzed under the EIS. Mining of the Saval/Steer, New Deep and Burns Basin mine areas would be implemented over a period of about

2

Response 2

Comments noted.

Response 3

Comment noted. Based upon comments received in response to this issue, the USFS has re-evaluated the effects that would be anticipated on the Jerritt Canyon Cattle and Horse allotment.

Calculations involving only the disturbance of high to moderate forage value ratings do not provide a complete assessment of remaining suitable acres available for livestock use and of the feasibility of administering an allotment management plan on the remaining suitable acres.

Under any alternative involving development of the New Deep open pit it would be necessary to close the entire Jerritt Canyon Unit. The Pot Holes and Dry Canyon Units would remain open to grazing. This would result in a 63% reduction of animal months during mining.

Under Alternative F, the New Deep ore body would be mined by underground methods and surface disturbance within the Jerritt Canyon allotment would be less. The maximum reduction in animal months would be 29%, or 213 animal months.

4 10 years and would occur in phases. The first phase would last approximately six years. The Forest Service could implement incremental reductions in AUMs on the Jerritt Creek Allotment in conjunction with the mine phases. With incremental AUM reductions and relocation of allotment boundaries by the Forest Service, the projected loss in AUMs will be lower than the levels displayed in the DEIS.

IMC has indicated in the Preliminary Plan of Operations that we would work with the Forest Service and affected livestock permittees in mitigating impacts to grazing. A fencing program corresponding to the mining phases appears to be a reasonable solution to minimizing these impacts.

3. WATER RIGHTS ISSUES

IMC representatives attended the EIS Open-house Meetings on January 4, 5 and 6 in Reno, Elko, and Tuscarora, respectively. During these meetings, some of the local ranchers raised the issue of effects to their water rights due to potential reduction in surface water flow. The DEIS discloses that reductions in surface water runoff to Jerritt and Burns Creeks relative to pre-mining conditions may occur as surface water is intercepted by pits (DEIS, p. 4-22, Table 4.5). IMC would like to clarify several points regarding this issue:

5 a. Water rights issues are the legal responsibility of the State Engineer's Office, Nevada Division of Water Resources, Department of Conservation and Natural Resources. A system is in place within this State agency to address impacts to water rights. The function of the DEIS is to display and disclose effects to the physical, biological and social environment. Disclosure of effects by the Forest Service does not authorize infringement on holders of water rights. IMC will have to address any actual impacts to water rights that may occur with the State Engineer and the affected parties. IMC believes that the EIS should acknowledge that the Forest Service approval of the POO does not authorize IMC to infringe upon the water rights of any local residents or land users, and that the resolution of the private water issues is a matter of state law.

6 b. IMC has monitored and will continue to monitor flow in Van Norman Spring, Niagara Spring, Burns Creek, and Jerritt Creek on a monthly basis, weather and access permitting. Some of these sites have been monitored continuously since 1982, and baseline flow data from some sites is available as far back as 1978 and 1979. The results of the surface and ground water monitoring program indicate that no discernable effects to water quantity have occurred as a result of IMC's mining operations since project implementation. In fact, surface and

Response 4

The USFS is reviewing IMC's proposed phased fencing program to decrease grazing reductions in the Jerritt Canyon cattle and horse allotment. This could help mitigate potential economic impacts to the grazing permittee.

Response 5

Comment noted. Water rights and their administration fall under the jurisdiction of the Nevada State Engineer's Office.

Response 6

Comment noted.

groundwater flow in the past year (1992-93) was the highest ever recorded at some of the monitoring locations.

7 c. The DEIS states that a 90 acre-foot and 520 acre-foot reduction in runoff to Jerritt and Burns Creeks, respectively, is projected to have occurred as a result of the existing and approved mining disturbances (DEIS, page 4-22). The computer model used to estimate these reductions on runoff evaluates the effects that would occur after mining and reclamation, including allowing water that is presently diverted around the Burns Basin pit to flow into this pit. As stated above, IMC's water monitoring program has detected no discernable reduction in flow. Therefore, the EIS should acknowledge the disparity between the computer model projections and field data. The EIS should further acknowledge the uncertainty in these projections and their apparent tendency to overestimate water reductions which are actually experienced as a result of the activities which are planned and analyzed.

Response 7

Comment noted. Watershed computer models are a good tool for comparative purposes but should not be used as a definitive method.

d. The DEIS states that surface water flows would be reduced relative to pre-mining conditions as water is intercepted by the pits. However, as stated in the DEIS (page 4-23), water intercepted by the pits would recharge the local groundwater system by infiltration through the bottom of the pits. This recharge may surface downstream as supplemental flow to streams, seeps and springs. Hydrogeochemical studies conducted in the area have documented that groundwater resources contribute in part to surface water flow. In addition, the pits that would actually be constructed during implementation of the proposed operation would likely be smaller than those displayed in the DEIS (approximately 460 acres vs 1332 acres) and would intercept proportionally less surface runoff.

4. GOSHAWK NESTS 127, 128 AND 074

8 The DEIS states on page 3-52 that alleged "historic" goshawk nests identified in previous surveys as nests 074, 127 and 128 have not been recently occupied by goshawks and are likely not goshawk nests. However, because these three nests are still listed as goshawk nests by NDOW they have, for the purposes of the DEIS, been evaluated as such. A review of NDOW's files on goshawk nest activity revealed that nests 127 and 128 have never been documented to be occupied by goshawks. In 1979 a goshawk was observed nesting in the vicinity of nest 074, but nest 074 has never been documented as being active by any bird of prey, including goshawks. We believe, therefore, that the DEIS should not identify nests 127, 128, and 074 as goshawk nests.

Response 8

Comment noted. These three nests are located in a nesting territory that was known to be occupied in 1979. For this reason, the USFS will continue to consider these nests as goshawk nests for this analysis. The affected environment section on goshawks has been re-written (Section 3.3 Management Indicator Species).

IMC has been supporting ongoing university studies of the effects of mining on goshawks in the Independence Range. At the

4

9 end of 1992, the study concluded that "no statistical effect of mining was observed on the productivity, dietary habits, or nesting area selection of goshawks" (Younk and Bechard, 1992). This finding should be included in the EIS.

5. MITIGATION AND MONITORING REQUIREMENTS

10 The Forest Service is required, under NEPA regulations to identify "appropriate mitigation measures that are not already included in the proposed action or the alternatives" (CEQ 40 CFR 1502.14 (f)). In addition, "agencies may provide for monitoring to assure that their decisions are carried out and should do so in important cases" (CEQ 40 CFR 1505.3). IMC agrees that mitigation and monitoring are important components of the decision made regarding the proposed action. IMC believes that the fisheries, macroinvertebrate, and riparian monitoring specified in the DEIS for Burns Creek are unnecessary, because the existing surface water monitoring program would detect changes in water quality and quantity. Any mitigation measures or monitoring programs proposed should be reasonable, implementable, and responsive to the impacts which are anticipated to arise from the proposed action. They should be directly related to the decisions made and the effects disclosed in the DEIS. Because these measures may become an integral part of the implemented decision, it is important that the Forest Service carefully consider the effects and costs of mitigation and monitoring programs and involve IMC in the design and planning of these programs.

6. SCOPE OF THE ANALYSIS

11 As required by NEPA, the Forest Service made extraordinary efforts to involve the public and other agencies in the EIS process through their scoping and public involvement plan. One purpose of this involvement is to determine early in the EIS process the issues to be evaluated and therefore the scope of the analysis. The Forest Service should carefully consider the level of detail that is used to address issues raised in the DEIS public comment period and not identified during scoping. Issues not previously identified and that are beyond the scope of the analysis should be dealt with as such and should not be used to expand the scope of the present analysis.

Timely completion of the FEIS by the Forest Service is crucial to allow continuation of IMC's current Jerritt Canyon mining operation. It is therefore imperative that issues and concerns raised during the public comment period be addressed as quickly as possible.

Response 9

Comment noted. The USFS concluded that adding preliminary information from the 1992 goshawk study is not appropriate at this time. The sample size for this study was eight breeding pairs and the study lasted three months.

Response 10

Comment noted. Further discussions were held between the USFS and IMC regarding the fisheries, macroinvertebrate and riparian monitoring proposed for the fishable section of Burns Creek. This monitoring would be implemented as part of any alternative that is selected. Details of monitoring would be included in the final POO.

Response 11

Comments noted.

IMC appreciates the opportunity to comment on the DEIS, and welcomes any follow-up questions or comments from the Forest Service.

Sincerely,

Scott A. Lewis for

Robert Micsak
Vice President/Chief Environmental Officer

cc: S.A. Lewis
Don Carpenter - Forest Service

Letter #8

Petan COMPANY OF NEVADA, INC.

YP RANCH

TUSCARORA, NEVADA 89834
TEL (702) 756-6512

Mtn. City Ranger District
JAN 18 '94
DFR
MINERALS
RA COORD
WL BIO
FORESTER
RANGE TECH
FOR TECH
SSA
TYPIST

January 17, 1994

Jack Carlson
Mountain City Ranger District
P.O. Box 276
Mountain City, Nevada 89831

Dear Jack,

Thank you for the opportunity to comment on the Draft Environmental Impact Statement for the Jerritt Canyon Mine expansion. The following are just a few of my concerns that have not been satisfactorily answered in the DEIS.

1 Jerritt Canyon Mine Expansion DEIS does not satisfactorily answer questions of surface and ground water quality. The DEIS states sampling of springs downgradient of existing waste rock dumps, "does indicate that sulfate concentrations are greater than the drinking water standards. However, no baseline data was collected from these springs, therefore, an increase in sulfate cannot be verafied". (See Page 4-7) As thorough as the U.S. Forest Service and Independence Mining Company are, I find it hard to believe that there is absolutely no baseline data. This should be of greater concern to you and the public. If this project will adversely affect the quality of our drinking water, due to ACID WATER RELEASE, how are you going to ensure the public's safety? Everybody that lives or recreates on private and public land downstream of this project should have a clear-cut answer on how ACID WATER RELEASE into ground and surface water will affect the human environment, wildlife, livestock and crop production for human, wildlife and livestock consumption.

2 IMC's current project has caused domestic water supplies to become contaminated allready. Domestic water supplies have become muddy and unsutable for domestic uses. Creeks have also become muddy from IMC's activities at the current operation.

1

Letter #8
Petan Company of Nevada

Response 1

Comments noted. Springs and seeps identified in the Project area were sampled in 1993 for water quality and quantity (see Tables 3.4 and 3.6 of the DEIS). Springs GDSP-10 and MCDS-10 would continue to be monitored. With the implementation of mitigation measures, such as a waste rock sampling and handling program, it is anticipated that water quality from the mine expansion operations would be in compliance with state water quality regulations.

Response 2

Comments noted. Existing water analysis for domestic water supplies indicate that they are in compliance with state water quality criteria and standards.

It is obvious that expansion of the mine site will continue to cause this unpleasant situation for the people downgradient of the proposed mine expansion.

3 The DEIS states that there will be a loss of surface water quantity downstream of the proposed expansion site and it will affect downstream water users. The loss of water quantity would be a loss of private property rights for downstream water right owners. This would be detramental to all downstream water users. Downstream water users should not be denied their right to use their full amount of allocated water.

Detramental impacts to ground water quantity is another concern. This expansion will have an adverse affect on springs and seeps for wildlife, livestock, irrigation and domestic uses. If the quantity of ground water is decreased and springs and seeps dry up, you will be taking away private property rights of those people that own the water rights.

4 The Jerritt Canyon Mine Expansion DEIS states that a reduction in AUM's of 50% in the Jerritt Canyon Cattle and Horse Allotment could be anticipated under all expansion alternatives, except the No Action alternative. Therefore, it is stated that the permittee(s) will suffer a 50% annual income loss off of the Jerritt Canyon Cattle and Horse Allotment. If this expansion becomes a reality, the permit holder(s) should be compensated for this loss by USFS or IMC. Compensation for loss of annual income should be determined by income that is potentially generated to the rancher(s) by the lost AUM's. The potential income should be paid to the permit holder(s) annually or in a lump sum. The lump sum should be paid to the permittee(s) every time they renew their grazing permit for 10 years. IE: Annual payments of lost income or a lump sum consisting of 10 years worth of anticipated lost income. A 50% reduction in AUM's will result in a definite loss of economic viability of a ranching operation. Any and all loss of AUM's should be compensated for; they are the backbone of all ranching operations.

5 In the spirit of the multiple use concept used by the USFS, it seems that closing public access to public land would be contrary to USFS policy. If you close access to the public you are denying our right to use our lands. As the population in Elko County increases, we cannot afford to have a loss of total useable land. If access for hunting, recreation and grazing is lost in this area, you are going to put more pressure on other public lands that may not be able to handle additional pressure. The more condensed pressure you put on other lands, the more it will cause the quality of the outdoors experience to decline. This would adversely affect the quality of the human environment.

Response 3

Approval of any POO by the USFS does not authorize a mining company to infringe upon the water rights of other parties. Water rights and their administration are the authority of the Nevada State Engineer's Office.

Response 4

Grazing permits on national forest lands are privileges that are revocable by the USFS without compensation. The EIS discloses potential impacts from the projected loss of livestock forage areas. Partial mitigation of potential impacts may sometimes occur through the reallocation of grazing resources on other allotments. It is Humboldt National Forest policy that grazing permittees who have had their grazing permits canceled because of mining operations will retain "preferred applicant" status, for forage available for reallocation under the grant process, until the expiration date shown on the permit or five years, whichever is greater.

A 50 percent reduction in animal months identified in the DEIS on the Jerritt Creek allotment does not equate to a 50 percent reduction on all animal months held by the allotment permittee. The allotment was evaluated for the FEIS and it was determined that there would actually be a 63 percent reduction in animal months for Alternatives B, C, D, E, and G. By building additional fences in the Project area, there would be a 29 percent reduction for Alternative F. The permittee also holds grazing licenses and permits on surrounding federal lands, both BLM and USFS.

The reduction in animal months may not be permanent. Once reclamation and revegetation have occurred, the USFS will assess the allotment for re-instatement of livestock grazing.

Response 5

Implementation of any action alternative would have an impact on users of public lands. It is the USFS policy to regulate the use of lands under its administration to meet management objectives. In this instance, closure of the mine area is necessary to provide for the safety of the public. As stated in the EIS, closure of the mine area may result in people using other federal lands. The closed area would be reopened with some safety restrictions in the future.

After reviewing the Jerritt Canyon Mine Expansion DEIS, it is evident that the proposed mine expansion will significantly affect the quality of the physical human environment. I strongly suggest that the USFS consider that the only alternative that is compatable with the physical human environment is Alternative "A": No Action.

Thank you for the opportunity to comment and I hope you will consider my comments when you write the Record of Decision.

Sincerely,

John C. Jackson

Letter #9

SIERRA CLUB

Toiyabe Chapter — Nevada and Eastern California
P.O. Box 8096, Reno, Nevada 89507

January 15, 1993

John Inman
Forest Supervisor
Humbolt National Forest
976 Mountain City Highway
Elko, Nevada 89801

Dear Mr. Inman:

Re: Jerritt Canyon Mine Expansion Project
Draft Environmental Impact Statement

The Sierra Club has had the opportunity to review the Draft Environmental Impact Statement (DEIS) for Jerritt Canyon and is greatly disappointed in both the adequacy of the document and the Humbolt Forest's choice of Alternative C as its preferred alternative. It is the Sierra Club's position that Jerritt Canyon, and the surrounding area to be affected by this proposed action, is too valuable in terms of its wildlife, recreational, visual, surface and ground water, grazing, wetlands and cultural resources to be as severely impacted as proposed. It is the Sierra Club's opinion that many impacts have been inadequately addressed in the DEIS and/or many of impacts insufficiently mitigated.

1 The actions being proposed by the Forest Service will result in a serious increase in the area to be disturbed. All the alternatives studied except Alternative A will result in a seven-fold to eight-fold increase in the acreage disturbed from what exists as disturbed or is permitted to be disturbed at present (in addition to exploratory disturbances and what is referred to in the DEIS as disturbances caused by developmental and condemnation mining within and adjacent to the mine area). There has been no alternative studied in this DEIS that would have looked at ways to drastically reduce the amount of disturbance resulting from this mine's activities. The lack of an alternative which does not require the large waste dumps across the drainage is inconsistent with NEPA, since no real alternatives were therefore considered. These new proposed disturbances will have significant impacts on land not now being mined and upon all the resource values listed above.

LAS VEGAS GROUP
P.O. Box 19777
Las Vegas, Nevada 89119

To explore, enjoy, and protect the wild places of the earth. . .

GREAT BASIN GROUP
P.O. Box 8096
Reno, Nevada 89507

Letter #9
Sierra Club

Response 1

Alternative C would increase total surface disturbance from the current 3,137 acres to 5,779 acres as shown in Table 2.1 in the DEIS. This represents an increase in surface disturbance of less than two-fold that which already exists. A variety of preliminary alternatives were examined as possible ways to reduce disturbance and to avoid the South Deep dump across Jerritt Creek. These preliminary alternatives and the reasons for eliminating them from further consideration were included in Section 2.5 "Alternatives Eliminated from Detailed Study". Alternative F, an alternative involving underground mining for the New Deep deposit, was examined as one way to reduce disturbance.

The Sierra Club is most concerned:

- that water resources have already been impacted by current mining and much larger impacts will result from the proposed expansion in all of the alternatives except for A. An insufficient study has been made of the Jerritt Canyon Mine's impact on both surface and ground water.

- that several species of concern (threatened, endangered, candidate, sensitive and management indicator species) have not been adequately studied or protected.

- that significant amounts of wetlands, as well as critical fish, wildlife and grazing resource will be destroyed needlessly.

- that much of the disturbed area will remain unreclaimed after final reclamation (pits, south-facing dump slopes, etc) resulting in an even greater loss of wildlife habitat and grazing resource.

2

- that the waste rock dumps, even as proposed in the preferred alternative, will prove to be unstable in the long run, will be inadequately vegetated and will be a visual eyesore that will preclude the long-term value of the entire Independence Mountains as a recreational resource.

- that other less damaging alternatives were not considered eg. an alternative to require closure and revegetation of all pits was not considered. It is the Sierra Club's contention that should this alternative alone be studied and implemented that many of the adverse impacts mentioned above could be avoided.

- the state of reclamation success and standards at the site to date may not be adequate to the needs to protect this valuable resource.

- that the forest service may be contributing to another boom-bust cycle in Nevada where American resources impacted and, in some cases destroyed, with much of the profits going overseas. That these short-term profits are being paid for through long-term destruction of resources leaving the people of Elko County vulnerable to future economic deficits and lessened resources upon which to build. And finally, that there may be insufficient guarantees that this future could happen overnight leaving the United States holding the bill for resource recovery.

It is the Sierra Club's contention that the 1872 Mining Law, as it is now written, does entitle companies to enter into and mine in most areas of the National Forest. It is, however, up to the Forest Service, and other agencies, to set the conditions, including sufficiently stringent reclamation standards, under which any such mining shall take place. (As has occurred when developed recreation areas such as ski areas are threatened by mining). As is stated on page s-vii

Response 2

Comments noted. The comments raised on this page are addressed in greater detail later in the letter. Responses are found next to the more detailed comments.

of the DEIS...federal, state, and local government agencies are to administer the laws, regulatory programs and quidelines for the protection of the environment.

3 It is the Sierra Club's contention that none of the alternatives currently under study would serve to adequately protect the environment and would cause relatively equal amounts of damage to the resource. Alternative A is the only alternative currently under study that would serve to adequately protect the resource. Although some people might interpret that alternative as in conflict with the 1872 mining law, it is the only alternative which does not violate the requirements of resource protection. The Forest Service needs to rethink the project and develop reasonable alternatives which do not violate environmental protection regulations, particularly for water quality, which also do not violate the 1872 Mining Law. This alternative does not have to minimize cost to IMC.

In the event that Alternative A is not a viable alternative, the Sierra Club formally requests that no decision be made or implemented until such time that all of the various inadequacies of the current study noted here have been addressed, including a lack of suitable alternatives. The Sierra Club would also formally request that we meet with representatives of the Humbolt National Forest to discuss the issues brought up in this letter.

Impacts to Surface and Ground Water

4 The mine as proposed is likely to cause major and irretrievable impacts on water quality in the Southern Independence. These are not adequately addressed or mitigated in the DEIS. Further study with clear monitoring, mitigation and agreed-upon penalties for violations should be required.

The proposed dump construction is unprecedented in Nevada and we believe, unprecedented in the western United States. Allowing water to permanently flow under a dump is contrary to all goals of keeping water out of reactive dumps and an invitation to permanent degradation of water quality. The Sierra Club has commented previously about the construction of this very large dump and we believe that it should not be permitted. Effectively no alternatives were presented to the proposed dumps, presumably due to "economic infeasibility", although no data were presented justifying this lack of feasibility. As proposed, the alternatives should appropriately be considered "environmentally infeasible". If there are not alternatives that are not environmentally infeasible and also economically infeasible, the deposit is no longer a minable ore body.

Passage of water under a very large unoxidized waste dump is an invitation to continued oxidation of sulfides, and degradation of downgradient water quality. High humidity and oxygen due to the continuous underflow will exacerbate microbial oxidation of pyrite, and increase the rate of acid generation.

Response 3

Any alternative that did not meet minimum engineering criteria and environmental protection standards, as mandated by various federal and state laws, would not be permitted by the authorizing permit authority. Analysis of effects indicates that such standards are not expected to be exceeded. In cases of question, such as the potential effects of acid rock drainage, a monitoring and mitigation program would be established.

Response 4

The analysis in the EIS does not predict major irretrievable impacts on water quality. Monitoring for potential water quality issues is presented in Appendix B. The State of Nevada is responsible for the enforcement of the Clean Water Act. The under-dump drain system for the waste rock dump in Jerritt Creek was analyzed for its ability to pass flood waters from a 100 year precipitation event, as indicated on pages 4-25 and 4-26 of the DEIS. Standards for the size and durability of the waste rock used to construct the under-dump drainage system would be included in the final POO. This EIS includes a program for sampling and handling potentially acid-generating materials in a manner that would prevent permanent water degradation.

5 The analyses suggesting that water quality will not be affected are not persuasive. The "Trace Metal Mobilization" discussion on page 3-8 uses a meteoric water mobility procedure (MWMP). To our knowledge, this test has no scientific basis in water quality management and should be discarded from the analysis. Despite being recommended by the Division of Environmental Protection, this test is not useful for regulatory purposes since it has never been verified as being predictive of drainage water quality by any scientific procedure. In addition, none of the data are presented from the tests, except that "several samples had slightly elevated arsenic, selenium, nitrate and sulfate concentrations." These contaminants (except nitrate, perhaps) are the very constituents which would be of the greatest concern. The Jerritt Canyon site has historic arsenic claims associated with it, and this element is a major concern. Elevated selenium and sulfate suggest oxidation products of sulfidic minerals, which is the very problem which is likely to cause drainage water quality problems.

The DEIS does not include any discussion on kinetic testing which provides additional information on acid generation potential, but only indicates that the results of kinetic testing will be discussed and evaluated in the FEIS. This is contrary to the requirements of NEPA, since the public will not be able to comment on those data. These data should have been presented in the DEIS, and inclusion only in the FEIS presupposes a decision which reduces public involvement.

6 Sediment loading has previously been a problem for this mine, and with the very large dumps being created at angle of repose, it is likely that sedimentation will be a problem with the present proposal. The mitigation section should require that the company assume responsibility for ensuring that sedimentation will be prevented. If sediment loading is exceeded, even during storm events, a schedule of fines and measures to eliminate sedimentation needs to be in place. This company has had violations of sediment loading in the past, they have violated Army Corps of Engineers requirements for filling in wetlands, and they have violated USFS regulations. There must be clear and unambiguous monitoring and enforcement stipulations in the EIS. This mine has a record of violations; the USFS needs to have clear agreements that new violations will be dealt with in a rapid and severe manner.

7 The DEIS admits that "sulfide oxidation could occur in isolated portions of the dump, but any acid produced should be neutralized by the surrounding waste rock that has high neutralizing potential". What basis is there for arguing that neutralizing will occur? If the system was homogeneous, some argument could be made for such a statement, but the method of constructing waste dumps is anything but homogeneous. The discussion of the New Deep waste rock is not persuasive that water quality will be protected. It simply states that waste rock may generate acid, and further plans will be made if problems occur. In fact, the New Deep contains rock which will almost certainly be acid generating, and due to the water and oxygen availability in the porous waste rock dump, acidification is likely. The resulting water draining off this site is almost certain to be contaminated.

But the paragraph of most concern is on page 4-7 which indicates that "sulfate concentrations are greater than the drinking water standards" in springs downgradient from two existing waste rock

Response 5

The MWMP data was briefly presented because it meets a state need. Conclusions on water quality were not based on this test data.

Response 6

Mitigation for sedimentation, including armoring angle of repose slopes with coarse and durable waste rock, would be a part of the approved POO. The State of Nevada is responsible for enforcement of the Clean Water Act.

Response 7

The neutralization potential data presented in Table 3.1 on page 3-6 of the DEIS provide evidence that neutralizing of acid-generating materials will occur. The waste rock sampling and handling plan (see Appendix A) would ensure that potentially acid generating material is placed in areas of the dump that are isolated from water and/or mixed with neutralizing material.

8 dumps. It suggests that because no baseline data were collected, the sulfate violations cannot be attributed to the waste rock dumps. However, it is highly unlikely that the increased sulfate concentrations came from anything but the waste rock dumps, and a presumption should be made that the mine is creating drainage that violates surface water standards for drinking water. It is thus very likely that the new waste rock dumps, which are very much larger, will also generate sulfate that exceeds drinking water standards, and thus a violation of state law. The USFS is now in a position of permitting a project which will almost certainly violate state law. The USFS should not permit such a project, and can deny the project on this basis alone. This mine is different than almost all other mines in Nevada in that it occurs in a high precipitation area. Water drives microbial processes that produce acid, and this mine should be considered on the same basis as other high elevation-high precipitation mines, including Summittville.

9 This waste rock dump proposal is a very grand experiment of over 1 billion tons of rock. If it fails, or begins to fail, the mine proponent needs to take responsibility up front for correcting the problem. The EIS needs to have a serious of regulatory limits, which will comply with the non-degradation standard in Nevada regulations. The USFS needs to be closely involved with regulation of water quality at this site, which is clearly within its purview, and responsibility. Bonding for this mine should include an insurance for acidification. Stipulations should require that the USFS can use the bond funds directly for water quality problems if violations occur.

10 No discussion is presented on the large body of water which will be created in the New Deep pit once mining is completed. Pit water studies are now expected for any major mine in Nevada. This study should consider the amount of water in the pit and the water quality which will be expected in the pit. If that water is degraded, the mine will be in violation of state law since it will allow the creation of a degraded water body.

11 The mine proponent has violated several regulations for water quality in Nevada, and an analysis of the impacts from this project should include a discussion of the record of the mine in previous activities. Violations of surface water quality from sedimentation and other contaminants should be addressed, as well as the very severe groundwater contamination from the tailings facility, as well as the violations of wetlands regulations should all be detailed in the DEIS. Each company establishes a record for environmental protection at a particular site; the record in this case is particularly poor, and the mitigation, enforcement and penalties of new violations should be a part of this DEIS.

12 Alternative F investigates the possibility of using underground techniques to mine the ore body. Although having other perhaps positive benefits, this option does hold the possibility that arsenic leaching may occur in these deeper rocks. The reports statement that any contaminated water could not exit portals is perhaps true but has not been adequately explained. There is also the real possibility that such contamination might exit fractures or other natural openings or contaminate the area's groundwater.

13 Evaporative losses of water due to storage in the Deep Pit have not been adequately addressed. Water quantity issues are also poorly or inadequately considered.

Response 8

Page 4-35 of the DEIS states "The high TDS and sulfate concentrations recorded for springs GDSP-10 and MCDS-10 may indicate either groundwater in equilibrium with ore deposits or the oxidation of sulfides in adjacent and upgradient waste rock dumps." Due to the lack of baseline data, we cannot verify the sources of sulfates. Monitoring of springs GDSP-10 and MCDS-10 would continue. Because of this concern, the waste rock handling plan for the mine expansion would segregate and isolate the potentially acid generating rock from water and air.

Response 9

USFS bonding requirements are for reclamation purposes (36 CFR 228.13). Based on the results of the geochemical study and with implementation of the waste rock plan, degradation of the water is not expected. In this situation, bonding for water quality problems is not appropriate. Also refer to Response 6.

Response 10

Under NAC 445.24352 (3), "Bodies of water that are the result of mine pits penetrating the water table must not create an impoundment which: (a) Has the potential to degrade the ground waters to the state..." Based on the waste rock characterization study results, degradation of water is not expected. Approval of mining below impounded water in the pit would not relieve IMC from complying with other state and federal laws. Evaporative water losses may be considered in an evaluation of pit water quality for the State of Nevada.

Response 11

Comment noted.

Response 12

Comment noted. A review of engineering information provided for Alternative F shows that the portals would be located at elevations between 6,400 feet and 6,800 feet. These sites are higher than the estimated regional groundwater level of 6,100 feet. It is anticipated that water would be encountered at 6,100 feet, but not under enough pressure to lift it to the 6,400 foot elevation.

The potential for groundwater contamination, including arsenic leaching, to occur within the underground workings is low. The workings would be sealed when mining is completed, water inflows would be controlled with shotcrete or other methods, and portions of the underground workings would be backfilled. With implementation of these measures degradation of groundwater quality is not expected.

Response 13

See Response 10.

It is also merely conjecture, and probably will not prove to be the case, that revegetated slopes will be superior to the present natural vegetation in reducing sediment loads (as stated on page s-ix of the DEIS).

Impacts to Wetlands, Vegetation, Wildlife and Grazing Resources

14 As noted in the EIS, riparian communities are one of the most important communities for wildlife and livestock, a rare enough resource in the Intermountain West. 3.7 acres of wetlands, largely of a linear nature, and 6.5 acres of stream channel would be destroyed with adoption of Alternative C. Five springs will be directly destroyed, two springs possibly heavily impacted and two seeps destroyed. Efforts proposed by IMC to mitigate the losses of these important wetlands will not result in the replacement of wetlands near the areas impacted (seven miles away) nor will monitoring of the condition of constructed wetlands continue longer than five years. The loss of permanent wetlands is being proposed to be replaced by constructed wetlands, possibly of a limited nature in a totally different habitat. The success of constructed wetlands is also a question; many constructed wetlands simply do not work as the natural systems do.

15 Aspen habitat is also disproportionately important to livestock, species of concern and wildlife in general, as described on page 3-45 of the DEIS. Already 335 acres of aspen (17% of that present in the permit area) has been destroyed with twice as much to be destroyed (42%) if Alternative C is implemented. In order to analyze the affect of the destruction of this much aspen on wildlife distribution and movement a fragmentation study was to have been undertaken. This was not accomplished. The Sierra Club takes the position that this investigation should be completed before final selection of an alternative and that other means should be studied to reduce the amount of aspen destroyed.

It is our contention that vegetative diversity will decrease markedly in the project area (see Inadequacy of Reclamation Standards section, below). The DEIS notes that grazing by both sheep and cattle has or soon will be reduced as a result of mining activities. This concern is all the more meaningful because the post-mining land use will be a combination of grazing, wildlife use and recreation.

16 The Sierra Club contends that greater efforts are warranted to seek alternatives that result in less destruction of wetlands, riparian areas, aspen stands, and areas with high grazing potential (see Lack of Suitable Alternatives section, below). Refilling of existing pits at the Jerritt Canyon previous mines is a very appropriate alternative to consider. An additional alternative is sequential mining of the Steer-Saval and New Deep pits, with refilling of one from waste rock of the other. It may cost more, but it could be done in a manner so as not to violate state water law.

Impacts to Wildlife and Species of Concern

Response 14

Comments noted.

Response 15

Comment noted. As stated in the FEIS, attempts were made to analyze the effects in terms of the distance between aspen stands and stand size. Effects to aspen fragmentation are analyzed and displayed in terms of the acreage of direct removal. There is only a 35 acre difference between the alternative with the least amount of aspen disturbance (Alternative F at 627 acres) and the alternative with the greatest disturbance (Alternative C at 662 acres). To fully address the issue of fragmentation with a quantified analysis would require the development of a complex computer program. This analysis was not performed because of the exorbitant cost and time involved for an effort that is not essential to a reasoned choice among the alternatives, when all alternatives have similar impacts.

Response 16

An interdisciplinary team developed a range of alternatives to respond to a variety of issues. As part of developing alternatives to address specific issues, it became apparent that reducing an impact for one resource could create new impacts to other resources. After an initial review of preliminary alternatives, several were either combined or were eliminated from further consideration. Refilling of existing and proposed pits was considered. Partial pit backfilling is a component of all of the action alternatives, with the greatest amount proposed under Alternative C. Backfilling beyond that displayed for the alternatives is not considered feasible. Surface mining operations in the Saval/Steer and New Deep pits would be performed concurrently in order to provide sufficient ore to the mill. As such, sequential backfilling would not be possible. IMC partially backfills open pits where technologically and economically feasible, and to date has partially backfilled portions of all but one of the existing pits at the Jerritt Canyon project. IMC will continue to utilize partial pit backfilling to the extent practicable.

17 The DEIS notes that mining activities could be affecting the endangered Lahontan cutthroat trout and the candidate species, redband trout. Final assessment of these effects and their mitigation had not been made when the Forest Service's preferred alternative was chosen. Both species have been found in close proximity to mining related disturbances or proposed disturbances. The aquatic survey done in 1978 was apparently not repeated for this DEIS. It is the Sierra Club's contention that much more information is needed on the plight of these two species in the study area before a final decision concerning the expansion of the mine can be made.

The situation concerning terrestrial and aboral species is just as disturbing. Potential habitat occurs in or near the project area for one endangered species (peregrine falcon) five candidate species (Preble's shrew, pygmy rabbit, loggerhead shrike, spotted frog and Mattoni's blue butterfly) and two sensitive species (flammulated owl and northern goshawk). Individuals of four of the species have been found within four miles of the project area while several northern goshawk nests and territories are within the project area. Perregrine falcons prefer high steep cliffs for nesting. Such cliffs may exist in or near the project area and would be considered critical habitat for that species. The Sierra Club has been informed that it is probable that one or more of these species is present within or very near the project area. As is noted in the DEIS, it is possible that one or more of these candidate species could become listed before the project is complete.

All five of Humbolt National Forest's management indicator species (northern goshawks, deer, sage grouse, and two species of trout), are found within or adjacent to the project area as are, presumably, the other species that they are meant to indicate. Seven goshawk nests are found within the project area. One-half of Jerritt Canyon is considered to be potential sage grouse habitat. Jerritt Canyon is also known to be some of the most productive deer habitat in its management area. In addition, there are seven golden eagle territories within 10 miles of the project area and at least one nest that has until now been deemed offlimits, that is within the project area and is now being proposed to be destroyed.

All of this points to the fact that the area being proposed to be mined is prime wildlife habitat and perhaps even critical wildlife habitat. Deer populations in the study area have shown a drastic decline over the last 20 years do to habitat losses yet the DEIS proposes to destroy even more habitat through unnecessary construction of waste rock dumps. Again, the Sierra Club contends that greater efforts are warranted to seek alternatives that result in less destruction of wetlands, riparian areas, aspen stands, deer wintering and fawning areas and other areas which display such high wildlife values (see Lack of Suitable Alternatives section, below). These concerns are all the more meaningful, as was noted above concerning grazing, because the post-mining land use will be a combination of grazing, wildlife use and recreation.

18 Again, it is the Sierra Club's position that much more information is needed on the plight of all species of concern potentially present in the study area before a final decision concerning the expansion of the mine can be made.

Response 17

Comment noted. New information has been added about Burns Creek in Section 3.3 Biological Environment. Additional information on Lahontan cutthroat trout is presented within the Biological Assessment included in Appendix D. Lahontan cutthroat trout occur outside the Project area on the east side of the Independence Mountain Range, as indicated on page 3-49 of the DEIS.

Response 18

Comment noted. Where appropriate, additional information has been added on various species.

Inadequacy of Reclamation Standards

19 The Sierra Club believes that the DEIS should analyze an alternative that would require IMC to backfill and revegetate all of its open pits. This would result in the reclamation of those areas and remove the need for disturbances and reclamation required by the construction of waste dumps as valley fills (which will greatly impact many resources and parts of which may prove very difficult to revegetate). This will also remove the possibility that IMC will close down operations before pits could be "voluntarily" backfilled.

20 Some soils will not be recovered (slopes greater than 30% and soils of 12 inches or less). The Sierra Club believes that other alternatives need to be explored where a greater percentage of the soil resource is recovered.

21 Prior to disturbance, a mosaic of vegetation types occupies the area to be disturbed; each reflective of differing topographic position, aspect and soil depth (10 -80 inches) and permeability of soils. After reclamation it is now proposed that a uniform depth of soil be put in place over a relatively well-drained substrate. This should make replacement of the sage community types easy to establish, however, reestablishment of south-facing and north-facing mountain shrub communities (requiring steep, rocky and south or north-facing slopes, respectively) and large aspen stands (requiring deep, moist soils or seeps) more problematic. The later three community types are important for winter range, cover (as well as fawning areas), food sources for deer and other wildlife. The Sierra Club contends that other alternatives to soil management need to be explored and that the probabilities of reestablishing diversity similar to similar undisturbed areas (as stated in the EIS) be reevaluated.

22 In our opinion, standards for reclamation should be stated in the DEIS. There should also be a statement of the amount for which IMC is currently liable for reclamation, the methodology used to arrive at past and future amounts of liability, the types of bonds held and the standards to be used to determine when bond amounts are released, the amount of reclamation that has taken place to date and the bonding amounts released to date and why.

23 Exploration and development activities have impacted significant acreage in the past and are proposed or anticipated to impact additional acreage in the future. A statement should exist as to how these disturbances are bonded. Standards for reclamation and bonding for these areas need to be spelled out in the report.

24 The Sierra Club would like to see standards for final allowable concentrations of such compounds as arsenic, selenium and mercury in the decommissioned heap pads and residues from the event ponds and also mention of the methods to be used to determine whether these standards have been met before release of bonding liability. Standards should also exist for the covering of heaps to protect the heap from surface water and the surface environment from erosion and exposure to materials within the heap.

Response 19

Comment noted. Response 1, Response 3 and Response 16.

Response 20

Analysis of soil data as presented in the FEIS indicates that sufficient quantities of soil are available to accomplish planned reclamation.

Response 21

Comment noted. Mitigation for alternatives C-G has been revised to address this concern. Growth medium would generally be spread to a minimum of 8 inches. Depth may vary as agreed upon by the USFS and IMC. Allocation of growth medium would be done to meet site specific reclamation goals. Refer to Section 2.4, Alternatives Considered for Detailed Study. The probability of reestablishing similar vegetation has also been reevaluated, and changes made in appropriate sections of the FEIS.

Response 22

Comment noted. Specific standards for reclamation activities and practices would be included in the final POO. Standards would be developed for the following areas: final configuration of the disturbed area; management of growth medium; mass stability requirements; acceptable plant species for vegetation; air, water, and visual standards; and conditions for bond release. This final plan would be approved after the signing of the Record of Decision and the approved POO would be available for public review.

A bond is in place to cover currently approved mining disturbance on USFS administered lands. This bond is updated yearly by the USFS. Standards for bond release are contained in the approved POOs.

Response 23

Comment noted. Exploration and development activities that are currently approved on USFS administered lands are bonded for reclamation under existing POOs. These plans include standards for reclamation and bonding calculations.

Response 24

Comment noted. There are no heap leach pads nor process ponds included in this mine expansion proposal. Existing ponds and pads are located on BLM managed lands and have been previously approved. The BLM has already conducted NEPA analysis examining the potential impacts of mine expansion on tailings impoundment facilities. Administration and jurisdiction for the Jerritt Canyon mill site is under the authority of the BLM and state agencies.

Visual Impact & Stability of Waste Rock Dumps

Alternative C will result in at least a seven-fold increase in on-ground disturbance. These disturbances will result most especially from roads and from the construction of excess waste rock dumps, necessitated by the non-mandatory reclaiming (filling) of the mine's pits.

Many of the steep slopes of these dumps will face south-west and will be nearly impossible to revegetate. Indeed, under IMC's proposal these slopes would be left intentionally unvegetated. Under all alternatives, these rather large disturbances will be visible to recreationists on site, from Independence Valley, and potentially in roadless areas to the north.

25 In any event, the relatively short-term economic gains made by the stockholders and employees of IMC will be more than offset by losses to the visual resource into perpetuity, including a possible long-term loss for the region of the entire Independence Mountain Range as a future draw for recreationists from outside the area. Trends would seem to support the idea that without a loss of visual and other values, that recreation from outside and from within the area would continue to increase for the foreseeable future; thus resulting in a long-term source of income for local economies.

Should the proposed waste dumps prove unstable, the area of disturbance would be increased with even greater impacts upon the visual resource and draw of the area, as well as, direct negative impacts to water quality and fishing recreational use.

26 The presence of water within or under a valley fill is the greatest threat to its stability. Five springs and two seeps underlie the dumps being proposed. Construction in steep terrain, as here, increase the probability of failure. There is no mention of buttressing the fills into the mountain-side or of a protective filter for the underdrains or of assured openings at each end of the drains.

27 Should the underdrain become clogged and the underdrain not be able to carry the volume of water going through it, a failure becomes probable. Reference is made on page 3-20 of the DEIS to a high flow of 80.1 cfs for Jarrit Creek. This is explained as questionable data as compared with other flows at the same time in adjoining watersheds. High variabilities in precipitation or runoff events in desert or semi-desert areas are the norm , as are intense thunderstorms localized to one drainage. (Reference the Big Thompson flood in Colorado). The underdrains would have to handle such an event if it occurred, for the far distant future. All things given, it does not appear that the stability of the mine dumps as currently proposed can be assured.

This concern is all the more meaningful because the post-mining land use will be a combination of grazing, wildlife use and recreation.

9

Response 25

Comment noted. Reclamation of mine disturbances will return the Project area to a productive condition based upon the post-mining land use objectives identified in Chapter 2 of the FEIS. Mitigation would be done to minimize visual impacts under all alternatives. Most of the area that was closed for public safety would be re-opened after reclamation. Recreational use of the area would resume.

Response 26

The "Saturated Foundation Soils and Seeps" portion of "Geotechnical Considerations" (section 4.2) discusses measures which would be implemented to ensure that groundwater development in the dumps and dumping on saturated foundations would not occur.

Response 27

Comment noted. See discussion in FEIS at Chapter 4.2 Physical Environment - Stream Channel Characteristics.

Lack of Suitable Alternatives

28 The problems associated with constructing the proposed mine dumps (disturbance to wildlife, species of concern, grazing, water, vegetation diversity, visuals and cultural resources, as well as, fears for their longterm stability and revegetation) could have been greatly reduced if an alternative addressing the mandatory filling and reclamation of all pits had been proposed.

29 Other suitable alternatives were also not investigated including the option of decreasing the extent of disturbance for this permit period until the success of current reclamation could be determined and the possible unmitigated impacts as a result of current and future mining could be adequately investigated. The Sierra Club position is that the absence of such alternatives as a serious flaw in the current FEIS.

Insufficiency of Information to the Public

30 The current DEIS is deficient in much of the information required by the public to make a full and reasoned assessment of significant environmental impact. Previous reports are referenced but important portions of those reports necessary for making sound judgements were not included in this DEIS. Changes to the mine plan since the adoption of the FEIS, including environmental assessment reports, should have been incorporated into this DEIS. Less than sufficient attention is given to increased impacts caused by changes to the mill site on BLM administered federal land. Less than sufficient treatment is given to problems that have existed since mining commenced at the site including, for example, increases or decreases in parameters for water quality. Inadequacies exist in this document and in incomplete agreements between agencies and between agencies and the mining company which will require further clarification or reevaluation by the administrative agencies involved before further public input can become forthcoming.

Impacts to Economic Viability of Local and National Community

31 The DEIS makes much of the relatively short-term gains to the local community in terms of jobs, revenues and real estate values. Much pressure of course exists to perpetuate such jobs and economic blessings for the community as long as possible. Certainly IMC's primary interest is in maximizing profits for as long as possible.

However, the current mining boom can not last forever, in Elko County or anywhere else. When the mines are played out and mining jobs disappear, people will move out of Elko county as fast as they moved in unless other resources remain in the county to sustain long-term development.

When Independence Mine and other mines in the area do close, which they will in the relatively near future or sooner if gold prices drop significantly, this will result in significant increases in unemployment, drastic drops in local revenues and real estate values along with the

10

Response 28

See Responses 1, 3, and 16. An EIS need not consider every possible alternative, but only reasonable alternatives.

Response 29

Existing operations are considered in this FEIS as part of baseline and cumulative conditions. Potential impacts of those operations have already been examined under separate NEPA documents. Actual on-the-ground impacts are monitored and mitigated under separate Plans of Operations and would continue to be so even if the No Action Alternative were selected for this current EIS.

Response 30

CEQ guidelines for implementing NEPA require agencies to reduce excessive paperwork by incorporating by reference and by "discussing only briefly issues other than significant ones." In order to meet this guideline, the USFS has incorporated by reference the POOs and environmental assessments you refer to (see asterisked items in the Reference Section of the FEIS) and has summarized these and the original 1980 FEIS as part of the existing operations described in maps, tables, and text. Effects analysis included review and consideration of the impacts described in the previous NEPA documents.

Response 31

The implementing regulations of NEPA require discussion of economic and social effects. As such, the DEIS presents the effects of the proposed mine expansion on the socioeconomic environment as described in Sections 3.5 and 4.5 of the EIS. Also examined are the potential effects from the No Action Alternative which would result in closure of the IMC mine in Elko County. Cumulative impacts from other existing and proposed mine operations anticipated for the reasonably foreseeable future are also discussed in the EIS.

Map 3.8 in the DEIS shows that most of the southern Independence Mountain Range has already been designated as mining districts. The Jerritt Canyon Mine Expansion general study area falls within the Jerritt Canyon Mining District, which extends beyond the forest boundary. Historical growth in the county's tourism industry appears to be related more closely to the gaming industry than to recreational opportunities in the Independence Mountains.

socioeconomic turmoil that will entail. It is imperative that the Independence Mountains remain visually, environmentally, hydrologically and culturally intact in order to serve as a magnet for tourist and sportsman dollars and as a source of resource utilization and renewal for the local community. That mistakes made in the relatively resent past are not repeated.

All the alternatives explored, with the exception of Alternative A, do much to guarantee that the Southern Independence Mountains will be greatly impacted by mining, especially in the areas of visuals, wildlife, vegetative diversity, wetlands and grazing potential. There is also the distinct possibility that future generations will be impacted by long-term changes to the hydrologic regime and losses of species diversity.

Humbolt National Forest is not Elko County's national forest, it is a resource for the entire country. Most of the land involved is land owned by all the American people. IMC is a foreign-owned company. The profits it extracts are largely for export. The commodity it produces, hard currency in the form of gold receipts, does little to strengthen the industrial or security interests of the United States (If anything, increased production at the mine may possibly serve to lower slightly the price of gold on the world market thus making the price of jewelry and a few substitutable industrial uses cheaper). At the same time, the Southern Independence Mountains are taking a long-term environmental hit from which, in large part, they may never recover.

No analysis is given of the profits made by IMC when the question of how complete reclamation should ultimately be.

It is imperative that the Forest Service realize its long-term responsibility for the health and welfare of the natural environment and the local human community dependant upon it. The United States Forest Service must not let itself become a part of merely another boom and bust cycle with potentially disastrous long-term repercussions.

Sincerely

Lois Snedden

Lois Snedden, Chair
Toiyabe Chapter

cc: Lynn Sprague, US Forest Service
Alex Levinson, Sierra Club
Phil Hocker, Mineral Policy Center
Barbara Boyle, Sierra Club
Ellyssa Rosen, Sierra Club
Senator Harry Reid
Senator Richard Bryan
Congressman Barbara Vucanovich

Letter #10

January 17, 1994

Jack M. Carlson, District Ranger
Mountain City Ranger District
Humboldt National Forest
P.O. Box 276
Mountain City, Nevada 89831

Dear Mr. Carlson:

The Nelo Mori Ranch submits the following comments on the Draft Environmental Impact Statement for the proposed Jerritt Canyon Mine expansion.

1 One concern I have pertains to any grazing allotments affected by the proposed expansion of mining operations. It is important that any area that is closed to grazing be reopened to grazing after mining operations are completed.

2 All affected areas should be reclaimed and special attention should be given to the introduction and spread of weeds in the project area.

I wish to be informed and involved in any future decisions pertaining to this matter.

Sincerely,

Nelo Mori

Nelo Mori
Nelo Mori Ranch

Letter #10
Nelo Mori

Response 1

Comment noted. The post-mining land use objective for forage/livestock states provisions would be made for seasonal livestock grazing on suitable reclaimed acres. After mining is complete, suitability would be determined by plant community type, vegetative productivity, topography, access and distance to water.

Response 2

Comments noted. With the exception of pits and armored waste rock dump faces, disturbed areas would be reclaimed and revegetated. A continuation of the existing noxious weed program would be included in the final POO for the mine expansion. This program would include conducting surveys for noxious weeds and control of noxious weeds within the mining areas.

Letter #11

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, Ca. 94105-3901

January 18, 1994

John Inman, Forest Supervisor
Humboldt National Forest
976 Mountain City Highway
Elko, NV 89801

Dear Mr. Inman:

The U.S. Environmental Protection Agency (EPA) has reviewed the **Jerritt Canyon Mine Expansion Draft Environmental Impact Statement (DEIS), Elko County, Nevada.** Our comments are provided pursuant to the National Environmental Policy Act (NEPA), the Council on Environmental Quality's NEPA Implementation Regulations, and §309 of the Clean Air Act.

The DEIS analyzes alternatives for a mining project which would involve excavation of four open pit mines and associated waste rock dumps, soil stockpiles, ore stockpiles, haul roads, and support facilities. The proposed project would disturb approximately 3,000 acres, most of which is public land. Alternatives to the proposed project were developed to address waste rock dump stability, revegetation potential, visual quality, stream flows, partial pit backfilling, and underground mining. The Forest Service Preferred Alternative, Alternative C, is different from the Proposed Alternative, submitted by the Independence Mining Company Inc.

1 We have appreciated the opportunity to review and comment on this DEIS in its preliminary stages. We believe that early coordination has facilitated the NEPA process. We do have concerns regarding the preferred alternative, however, based on its potential impacts to water quality and quantity, air quality, and vegetation. We recommend that the Final Environmental Impact Statement (FEIS) provide additional information regarding these issues as well as cumulative impacts and wetlands mitigation. We have rated this DEIS as EC-2 -- Environmental Concerns-Insufficient Information (see enclosed "Summary of Rating Definitions and Follow-Up Action"). Our specific comments are enclosed.

Please send a copy of the FEIS when it is officially filed with our Washington, D.C., office. If you have questions, please

Printe. on Recycled Paper

Letter #11
US EPA

Response 1

See responses to specific EPA comments below.

2

call me at (415) 744-1574, or have your staff contact Jeanne Geselbracht at (415) 744-1576.

Sincerely,

David J. Farrel, Chief
Environmental Review Section
Office of Federal Activities

001761/93-460

Enclosures

cc: Captain Rod Gettng, U.S. Army Corps of Engineers
Rory Lamp, Nevada Division of Wildlife
Russ Fields, Nevada Division of Minerals
Llee Chapman, Elko County Commission
MaryJo Elpers, U.S. Fish & Wildlife Service

Cumulative Impacts

2 We note that the environmental assessment for the tailings impoundment on Bureau of Land Management land is incorporated by reference into this DEIS. However, it does not appear that the cumulative impact analysis in the DEIS addresses impacts associated with the impoundment. The second phase of the tailings facility will be constructed to accommodate tailings from the proposed project. Pursuant to 40 CFR 1502.4(a) and 1508.25(c), the FEIS should describe and discuss the cumulative impacts to environmental resources from the 30,000-ton facility as well as other activities in the general vicinity of the proposed mine project, including those outside of Forest Service jurisdiction.

Water Quality and Quantity

3 The FEIS should provide the results of the kinetic tests that have been conducted to determine acid generation potential of the various formations in the project vicinity. The FEIS should also discuss how waste rock with acid potential would be isolated or encapsulated in the waste rock dump so as to avoid contact with meteoric or underdrain waters. The FEIS should discuss how water from pits or the underdrain would be treated should it become contaminated as a result of acid rock generation.

4 The project would result in a decrease of runoff of greater than 1,000 acre-feet per year in Jerritt Creek and Burns Creek because the runoff would flow into open pits. Some of the diverted water is expected to percolate back to groundwater, and some would evaporate. The FEIS should estimate the loss of water to evaporation and describe the effects of runoff reduction on stream flows in Jerritt and Burns creeks, including impacts to beneficial uses and groundwater availability. If reductions would result in significant impacts, we recommend that the Forest Service seriously consider runon/runoff diversion structures to channel water away from open pits and into these streams or purchase existing senior water rights in the area to replace depletions.

5 According to the DEIS (p. 4-33), if flow decreases and impairs use of Niagra Spring, appropriate mitigation would be implemented. Pursuant to 40 CFR §1502.14(f) and §1502.16(h), the FEIS should describe the mitigation measures that would be implemented. Functions and values of other springs and seeps could also be adversely affected by dewatering and burial under waste rock dumps. The FEIS should describe and commit to

1

Response 2

Comment noted. Additional information has been added to the FEIS. Incorporating the new tailings pond EA by reference is consistent with the CEQ guidelines for NEPA that require agencies to reduce excessive paper work by incorporating by reference.

Response 3

Comments noted. Results of the kinetic testing have been added to Chapter 4 of the FEIS. An overview of the waste rock sampling and handling plan has been completed and included in Appendix A of the FEIS. The treatment of potential future acid rock drainage is not discussed in the FEIS as it is not anticipated to occur. If it does occur, appropriate measures would be taken which could include water treatment.

Response 4

Approximately 60 percent of the total predicted decrease in runoff in Jerritt and Burns Creek would result from existing and approved disturbance as displayed in Table 4.5 in the DEIS. It is projected that Alternative F would result in an increase of 80 acre feet per year in Jerritt Canyon compared to the No Action Alternative. Under NAC 445.24352 (3), "Bodies of water that are the result of mine pits penetrating the water table must not create an impoundment which: (a) Has the potential to degrade the ground waters of the state..." Based on the waste rock characterization study results, degradation of water is not expected. Approval of mining below impounded water in the pit would not relieve IMC from complying with other state and federal laws.

Response 5

Approval of any POO by the USFS does not authorize a mining company to infringe upon the water rights of other parties. Water rights and their administration are the authority of the Nevada State Engineer's Office. Presently, the area is in the adjudication process. Flow from springs that would be covered by waste rock dumps would be relocated to the downstream side of the dumps using trench drains or the under-dump trench drains.

mitigate all reductions in flow at other springs and seeps, should this occur as a result of dewatering.

6 The FEIS should indicate how many years it would take for springs and seeps within the three-mile cone of depression to recover after dewatering ceases.

7 The FEIS should discuss the potential for partial backfilling of the New Deep pit. The FEIS should also evaluate the potential for partial backfilling of the pit with waste rock with high acid potential so that it is submerged below the surface of the pit water. The potential effects of such disposal should be assessed.

Wetlands and Other Waters of the U.S.

8 We understand that the U.S. Army Corps of Engineers is a cooperating agency for this EIS and that this EIS will serve as the NEPA document for the Clean Water Act §404 permit. We recommend that the detailed wetland mitigation and plan be included or summarized in the FEIS.

Air Quality

9 According to the DEIS (p. 4-19), mitigation measures specified in the air quality permits for mine crushing and screening facilities would "ensure that the pollutant emissions would be within acceptable limits and would not cause unacceptable impacts upon the air quality of the area." No mitigation measures beyond those required by the permits are proposed for this project. However, it is unclear from the DEIS whether the permits include mitigation for fugitive emissions of PM10 (particulates smaller than ten microns) and whether or how fugitive emissions would be appropriately mitigated. We recommend that the Forest Service require the project sponsor to include measures to minimize fugitive emissions from blasting, crushing, haul roads, and other sources.

10 According to the DEIS (p. 4-19), impacts to air quality would be considered significant if the project would cause or contribute to exceedences of Prevention of Significant Deterioration (PSD) increments. However, the document does not describe the project's potential direct or cumulative impacts to PSD increments, so it cannot be determined whether it would contribute to exceedences of PSD increment. The FEIS should describe how project emissions would affect PSD increments.

The proposed project includes visual monitoring of fugitive dust emissions from haul roads and crushing activities (DEIS, p. 2-

Response 6

There is insufficient hydrogeologic data to analyze the potential duration of impacts to springs and seeps in the complex and fractured bedrock aquifer at Jerritt Canyon. Active dewatering is currently not anticipated due to the small predicted inflows that could be handled through temporary storage in sumps and use for dust suppression or other uses.

Response 7

Comment noted. The New Deep pit would be the last pit completed in the proposed project. Opportunities for backfilling this pit were examined during preparation of the DEIS. Backfilling of the New Deep pit would entail stockpiling waste and then backfilling the pit after mining is completed. This is not feasible due to economics. Where operationally feasible, IMC would backfill portions of the other pits.

Response 8

Comment noted. The Wetland Mitigation Plan has been included as Appendix C.

Response 9

A baghouse, water sprays, and ore moisture are used to control PM-10 emissions from the mine crushing and screening system. The air quality permits already issued to IMC provide for visual monitoring of fugitive dust emissions from haul roads and crushing activities. The surface disturbance permit for the Jerritt Canyon operations was amended to include the disturbances associated with the mine expansion and new tailings pond in 1992. In these permits, NDEP also has and would in the future require mitigation measures to control fugitive dust emissions.

Response 10

Before NDEP would grant any new air quality permits, IMC would have to demonstrate through dispersion modeling that their proposed project would not cause or contribute to exceedences of any air quality standard or PSD increment. The dispersion modeling recently conducted for the mine crushing and screening system indicated that no air quality standard or PSD increment would be exceeded.

The air quality permits already granted require visual monitoring of fugitive dust emissions from haul roads and crushing activities. The permits also require control of fugitive dust emissions by watering or chemical stabilization of disturbed areas and by control of moisture in the ore. Any permits to be issued by NDEP for the mine expansion also would specify mitigation measures and monitoring, reporting, and contingency requirements that NDEP would determine necessary to ensure that the air quality standards are protected.

11 42). However, it is unclear what purpose this monitoring would serve because specific information regarding action levels and contingency measures are not provided. The FEIS should discuss how the monitoring would be conducted and identify the baseline concentration in the project vicinity, the visual standard that would apply, the criteria that would be used to determine exceedence of the standard, and the contingency measures that would be taken should the standard be exceeded.

<u>Vegetation</u>

12 According to the DEIS, 662 acres of aspen community would be directly affected by the preferred alternative, and greater than 1,200 acres of aspen community would be cumulatively affected. This represents approximately 20 percent of the this vegetation community in the Independence Mountains and appears to be a significant impact. We encourage the Forest Service to mitigate for as much of this loss as possible in order to protect the ecological diversity of the area. The FEIS should indicate how many acres of aspen community will be regenerated following mine closure and how mitigation/regeneration would be accomplished.

13 According to the DEIS (p. 2-8), approximately 194 acres of disturbance designated for final reclamation at existing Jerritt Canyon operations have been reseeded. The FEIS should describe the success of the revegetation effort thus far and any results that can be fed back into the reclamation plan to improve the success of future revegation efforts.

Response 11

Comment noted. The routine visual monitoring of fugitive dust emissions would be done by IMC personnel in accordance with the requirements of the air quality permits. NDEP could at their discretion inspect the area at any time. Ambient air quality was previously conducted at the Jerritt Canyon mill site as discussed on page 3-16 of the DEIS. This location was selected because it had the greatest number of sources concentrated in one area. The air quality permits for the mine crushing and screening system have opacity limit over a specified time interval. Exceedance of the specified opacity requires NDEP notification.

Response 12

Comment noted. Further analysis of on-site reestablishment indicates that the success of this mitigation is unproven. IMC and the USFS have and would still attempt to reestablish aspen on reclaimed sites, but this work would be considered experimental for the time being. Fragmentation of aspen habitat that would occur under the proposed action or the alternatives would be partially mitigated by off-site activities. These activities would include aspen reintroduction into sites that have previously supported aspen; treating existing aspen stands to improve viability; and assisting the USFS in riparian area management. These three activities may involve fencing.

Response 13

Comment noted. Evaluation of ongoing revegetation work was initiated in 1993. Results are not available for inclusion into the FEIS.

Letter #12

January 17, 1994

Mr. John Inman, Supervisor
US Forest Service
Humboldt National Forest
976 Mountain City Highway
Elko, Nevada 89801

Dear John:

Please accept these comments to the Jerritt Canyon Mine Expansion Draft EIS.

Some of my comments may not have been brought to light in the original scoping hearings (of which I was not made aware); however, as provided for in 40 CFR 1508.14 when economic or social and natural or physical environmental effects are interrelated, then the EIS will discuss all of these effects on the human environment. Also, scoping is a continuing process and, as provided for in 40 CFR 1501.7C; "An agency shall revise....if significant new circumstances or information arise....".

My comments will generally be addressing 3 subject areas in the Draft EIS; those being water, livestock grazing and socio-economics; and the proposed mitigation or lack there-of.

40 CFR parts 1502.14F, 1502.16H and 1508.14 specify that mitigation measures must cover the range of impacts, even those that by themselves would not be considered significant.

1 WATER - Throughout the DEIS there is mention of impact and probable decrease in quantity and quality of water in Jerritt and Burns Creeks as well as Niagra and Van Norman Springs. The water furnished from these sources collectively, is used to satisfy the needs for domestic, stock water, and agricultural irrigation of downstream ranchers. These ranchers hold vested rights or applications for vested rights in these sources. These rights are recognized as private property in the State of Nevada and having value. It is mentioned that should the project adversely impact these waters "appropriate mitigating measures will be taken.....". The DEIS does not further spell out the measures or the timeliness of recognizing the impacts or of taking the mitigating measures. Recognize that water for livestock and production of agricultural crops is only effective if available when needed. Please furnish me with all available information, documentation and verification of the afore mentioned mitigation measures and the proposed implementation schedule.

Letter #12
Jim Connelly

Response 1

Comments noted. Approval of any POO by the USFS does not authorize a mining company to infringe upon the water rights of other parties. Water rights and their administration are the authority of the Nevada State Engineer's Office. Also please refer to Table 4.7 "Potential Change in Sediment Yield by Alternative" and Table 4.5 "Change in Pre-Mining Condition Runoff by Alternative" and associated text discussions for information.

Mr. John Inman Page 2

2 LIVESTOCK GRAZING - The DEIS notes that there will be a 50% cut in AUM's on the Jerritt Canyon Cattle and Horse Allotment. It also makes mention of the closing of the Jerritt Canyon Sheep Allotment in January 1993 due to proximity of mining activities, as was a portion of the Mill Creek Allotment. The DEIS makes no mention of mitigation for the lost AUM's or income generating capacity other than maintenance and/or relocation of fencing and water developments if warranted.

3 I would like to comment first on the cuts in AUM's. The DEIS shows a 27% short term impact and a 9% long term impact to the Jerritt Canyon Cattle Allotment. Please furnish me with information, documentation and justification for the total closures and the anticipated 50% reduction in livestock grazing for Jerritt C&H.

While the type of right and the degree of compensability is still being debated with regard to grazing preference, suffice it to say that some type of right, charter, or tenure does exist (Buford v Houtz, 1890). Also, while every subsequent public land and resource management law, including the Taylor Grazing Act of 1934, state that they don't create any right, title or interest; neither do they extinguish any valid existing grazing right. The Government has always allocated that portion of forage value over and above the federal fee to the owner of the grazing preference. The IRS taxes the deceased ranchers estate based on the total size of the operation including the federal grazing permit and there is case history of the military compensating ranchers for lost AUM's. Please confirm for me the measures to be taken to mitigate the loss in income generating capacity, viability and property value of the ranch due to the cuts in grazing AUM's. If there is no compensation anticipated, was a Takings Implication Assessment done as per Executive Order 12630? Please justify.

4 NEPA states than an EIS shall be included in every recommendation significantly affecting the quality of the human environment. 40 CFR 1508.14, Sec. 102 (2) (C) NEPA. There is ample precedent for doing an EIS when the anticipated action is to raise stocking levels by 50%. Conversely then, it would seem that a 50% reduction in stocking rates would also be deemed a significant inpact. Please document and justify for me if an EIS was done regarding the closing of the Jerritt Canyon Sheep Allotment or the 50% reduction on the Jerritt Canyon C and H Allotment.

5 SOCIO-ECONOMICS - Throughout the DEIS socio-economic impacts are addressed in reference to census and demographic data for Elko County, Elko City and Carlin; not the rural communities or ranching community.

Response 2

Grazing permits on national forest lands are privileges that are revocable by the USFS without compensation. The EIS discloses potential impacts from the projected loss of livestock forage acres. Partial mitigation of potential impacts may sometimes occur through the reallocation of grazing resources on other allotments. It is Humboldt National Forest policy that grazing permittees who have had their grazing permits canceled because of mining operations will retain "Preferred Applicant" status for forage available for reallocation under the grant process, until the expiration date shown on the permit or five years, whichever is greater.

A 50 percent reduction in animal months identified in the DEIS on the Jerritt Creek allotment does not equate to a 50 percent reduction on all animal months held by the allotment permittee. The allotment was evaluated for the FEIS and it was determined that there would actually be a 63 percent reduction in animal months for Alternatives B, C, D, E, and G. By building additional fences in the Project area, there would be a 29 percent reduction for Alternative F. The permittee also holds grazing licenses and permits on surrounding federal lands, both BLM and USFS.

The reduction in animal months may not be permanent. Once reclamation and revegetation have occurred, the USFS will assess the allotment for re-instatement of livestock grazing.

Response 3

Comment noted. Based upon comments received in response to this issue, the USFS has re-evaluated the effects that would be anticipated on the Jerritt Canyon Cattle and Horse allotment.

Calculations involving only the disturbance of high to moderate forage value ratings do not provide a complete assessment of remaining suitable acres available for livestock use and of the feasibility of administering an allotment management plan on the remaining suitable acres.

Under any alternative involving development of the New Deep open pit it would be necessary to close the entire Jerritt Canyon Unit. The Pot Holes and Dry Canyon Units would remain open to grazing. This would result in a 63% reduction in animal months during mining.

Under Alternative F, the New Deep ore body would be mined by underground methods and surface disturbance within the Jerritt Canyon allotment would be less. the maximum reduction in animal months would be 29% or 213 animal months.

Mr. John Inman Page 3

6 The loss of income generating capacity to the long-term tax base provided by the impacted ranchers is not well addressed in the DEIS. Mining utilizes a non-renewable resource, and is relatively short term. Ranching utilizes a renewable resource, long term, and creates 5-7 dollars for every dollar raised. Many of these ranchers are third generation or more and must provide for retirement income as well. All of which is dependent upon their property values as well as income generating capacity. If Elko County is to remain whole in the long term (post mining) it must protect its agricultural base, see that it's ranches and farms remain viable through the short term.

Please furnish me with all information, documentation and justification that these impacts are being addressed and how they will be mitigated with respect to the Jerritt Canyon Mine Expansion Draft EIS.

Sincerely,

James E. Connelley
HC 35 Box 30
Mountain City, Nevada 89831
702-763-6644

Response 4

Response - Changes in resource status which result in reductions of permitted livestock numbers can be handled administratively, as was the case with the Jerritt Canyon Sheep and Goat permit in 1993. Discussions involving reductions were initiated with the affected permittee two years before any reductions were made. The reduction on the Jerritt Canyon Cow and Horse allotment is an expected impact of the mining expansion which is a part of this EIS. Any future reductions would be handled according to the USFS policy for administration of USFS grazing permits.

Response 5

Analysis of effects to population, economy, employment, housing, financial resources, public facilities and services are based on historical trends and the best available existing information. Where such information indicated specific areas of potential impact or ability to meet projected needs, such as availability of housing in Spring Creek, this information was discussed in Section 4.5 of the DEIS.

Response 6

The potential loss to the tax base would be a minor indirect consequence if it occurred. Many other factors affect the tax base of Elko County. The proposed operations may have indirect effects to adjacent landowners, including quantified projections for loss of animal months and surface water as identified in the DEIS.

Letter #13

COMMISSIONERS
LLEE CHAPMAN
MIKE NANNINI
DALE PORTER
ROBERTA K. SKELTON
BARBARA WELLINGTON
GEORGE R.E. BOUCHER
COUNTY MANAGER
(702)738-5398

Board of County Commissioners

ELKO COUNTY COURTHOUSE
ELKO NEVADA 89801

Mtn. City Ranger District
JAN 18 '94
ACTION
DPR
SUPRV RNGE.
MINERALS
E.A. COORD.
WL BIO.
FORESTER
RANGE TECH
FOR TECH.
S&S
TYPIST

January 18, 1994

Mr. Jack Carlson
U.S. Forest Service
P.O. Box 276
Mountain City, NV 89831

Dear Mr. Carlson:

The Elko County Commission appreciates being included as a cooperating "agency" on the Jerritt Canyon Mine Expansion Environmental Impact Statement. Overall, the DEIS has incorporated many earlier comments and provides a comprehensive analysis of the environmental, social, and economic resources that would be affected by each alternative. The selection of Alternative C as the Forest Service preferred alternative seems to reach a reasonable balance between environmental protection and socioeconomic considerations. We support the designation of Alternative C, as explained in the DEIS, as the selected alternative in the FEIS.

The Elko County Commission has the following comments on the Draft.

1 — 1. Chapters 2 and 4 of the EIS should clearly state that Alternatives D and E are not considered economically feasible to implement by Independence Mining Company.

2 — 2. The increased surface disturbance, beyond that for Alternative B, attributable to creating 3:1 slopes under Alternatives C and D should be specified in the test of Chapter 2.

3 — 3. The 50 percent reduction in AUM's specified in Chapter 4 for the Jerritt Canyon cattle and horse allotment is not justified by the information presented in the DEIS. The Forest Service should revise this proposed reduction to reflect the fact that only 27 percent of the good quality forage will be removed and that this will not happen instantaneously, but would occur over the life of the proposed expansion.

Letter #13
Elko Board of County Commissioners

Response 1

Comment noted. All alternatives are assumed to be economically feasible to implement for analysis purposes throughout the FEIS.

Response 2

Comment noted.

Response 3

Comment noted. Based upo comments received in response to this issue, the USFS has re-evaluated the effec hat would be anticipated on the Jerritt Canyon Cattle and Horse allotment.

Calculations involving only the disturbance of high to moderate forage value ratings do not provide a complete assessment of remaining suitable acres available for livestock use and of the feasibility of administering an allotment management plan on the remaining suitable acres.

Under any alternative involving development of the New Deep open pit it would be necessary to close the entire Jerritt Canyon Unit. The Pot Holes and Dry Canyon Units would remain open to grazing. This would result in a 63% reduction in animal months during mining.

Under Alternative F, the New Deep ore body would be mined by underground methods and surface disturbance within the Jerritt Canyon allotment would be less. the maximum reduction in animal months would be 29% or 213 animal months.

Mr. Jack Carlson
January 18, 1994
Page - 2

4 4. Several issues (i.e. water rights, dust, etc.) were apparently raised at the public open houses for the DEIS that are outside of the authority of the Forest Service. The DEIS identifies impacts to these resources and the FEIS should indicate that the State of Nevada has responsibility for these resources.

Considering the importance of Independence Mining Company's operations to Elko County, we urge the Forest Service to minimize major changes or further delays in finalizing the expansion EIS. I look forward to working with you during preparation of the FEIS.

If you have any questions, please do not hesitate to contact me.

Sincerely yours,

BOARD OF COUNTY COMMISSIONERS
County of Elko
R.L. Chapman, Chairman

George R. E. Boucher

by GEORGE R.E. BOUCHER
Elko County Manager

RLC/jw

Response 4

Responsibility for enforcing various state and federal requirements and related permits is displayed in Table 1.1 in the EIS. The USFS is responsible for ensuring compliance with the POO and regulations in 36 CFR 228 subpart A. The appropriate state and federal agencies (listed in Table 1.1) are responsible for enforcing compliance.

Letter #14

STATE OF NEVADA
DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES

DIVISION OF WILDLIFE

1100 Valley Road
P.O. Box 10678
Reno, Nevada 89520-0022
(702) 688-1500 • Fax (702) 688-1595

BOB MILLER
Governor

PETER G. MORROS
Director
Department of Conservation and Natural Resources

WILLIAM A. MOLINI
Administrator

Mtn. City Ranger District
JAN 14 '94
ACTION
DFR
SUPRV RNGE
MINERALS
E.A. COORD
WL BIO
FORESTER
RANGE TECH
FOR TECH
S.S.S
TYPIST

January 11, 1994

Jack M. Carlson, District Ranger
Mountain City Ranger District
Humboldt National Forest
P.O. Box 276
Mountain City, NV 89831

RE: Jerritt Canyon Mine Expansion Draft Environmental Impact Statement - Independence Mining Company - USFS

Dear Mr. Carlson:

We appreciate the opportunity to review and provide comments on the subject document.

The Memorandum of Understanding between Independence Mining Company, the Nevada Division of Wildlife and the Humboldt National Forest set forth an agreement concerning the mitigation of IMC's impacts from mineral development on deer habitat in the Independence Range. IMC has contributed funds to NDOW for management of deer habitat. These funds will meet IMC's mitigation requirements for all possible past, present and future long term impacts of IMC's mineral development on up to a total of 5,500 acres of deer habitat. Our mule deer input in this document meets the intent of the MOU in that NDOW shall not abrogate any legal responsibility to identify and submit input that would promote best management practices for deer habitat. However, should such management practices for deer habitat result in the increase costs for IMC, those practices would only apply at the option of IMC since deer habitat impacts have been fully mitigated by IMC through payment of the contributed funds.

Comment on the Summary

1 In the discussion under Location and Topography, the document indicates that waste rock dumps would result in greater areas of flat terrain. This design feature could prove to be detrimental to some existing wildlife resources in the Independence Range. For mule deer, the value of the Jerritt Canyon Drainage is in the forage found on the steep south facing slopes. Typically, the snow on the south facing slopes would melt and these areas would be available for mule deer to forage on. This fact, linked with the temperature inversions common to northeastern Nevada, would allow deer to move into Jerritt Canyon once the environment in the valley

Letter #14
NDOW

Response 1

Comment noted. We concur that the flat reclaimed areas may not be suitable mule deer winter range habitat. A discussion on this concern has been included in Section 4.3 of the FEIS.

Jack Carlson
January 11, 1994
Page 2

floors became untenable. The flat areas are expected to load up with snow and be unavailable for deer during winters when snowfall depths are average or above average.

2 In Section 2.4, Alternative B, under the discussion of Waste Rock Disposal Areas, the document indicates that slash would be burned or piled in non-critical areas. We would suggest that as much of the slash as can be salvaged be kept to improve the reclamation efforts. Experience has shown that slash improves the success of revegetation on mine dumps. In addition the material can be used by wildlife as habitat on the reclaimed disturbances.

3 The same section discusses the design of the dumps with flat tops. To improve the design of the dumps for wildlife it would be recommended to increase the amount of topographic diversity on the dumps and keep the flat surfaces to a minimum. Small hills, lobes, rock piles, and other features could be included in the dump design prior to construction, to enhance the topographic diversity of the dump surfaces. This in turn would increase the diversity of the vegetation that becomes established on the dumps. The greater the diversity of vegetation, the greater diversity of wildlife species that will return following the mining activity. An example of this type of construction is included in the DEIS on Page 2-47 in the discussion on Raptor Habitat. The text states that rock piles, simulating outcrops, will be placed on the dumps for raptor perches and cover for small mammals. This type of planning could provide numerous benefits to many types of wildlife if it is included in the design of the dumps.

4 Along with designing topographic diversity into the dumps, it will be important, from a wildlife perspective, to utilize plant species that will support the wildlife that are expected to return to the disturbed areas. An emphasis on native species or wildlife preferred non-native species should be included with the mine plan.

5 In Section 2.6, Management, Mitigation and Monitoring, in the discussion on Raptor Habitat, the document states that aspen and other woody plants will be planted to provide habitat for goshawks and other wildlife. Introduction of aspen to waste rock dumps has been shown to be very difficult. Work conducted elsewhere has yet to show that aspen can survive to maturity on reclaimed waste rock. Aspen habitat is extremely important to wildlife species in the Independence Range. Specific mitigation measures mentioned for losses of historic goshawk nests and foraging areas, (namely "hacking goshawks, and planting of aspen and other woody species on flat waste rock dumps") would appear to be inadequate because no suitable unoccupied goshawk habitat exists within the Independence Mountain Range in which to hack young birds. If successfully reestablished, the use of these stands would take up to eighty years before they are mature enough for nest sites.

Response 2

Comment noted. Mitigation measures for the use of slash in reclamation work have been revised. See Section 2.4, Alternatives Considered for Detailed Study. Accessible slash would be salvaged from pit areas and stockpiled for use in reclamation of existing and proposed disturbances. The final POO would include details for salvage and distribution of slash.

Response 3

Comment noted. A mitigation measure specifying that topographic features be designed and included in the reclamation of flat and 3:1 dump surfaces has been added to Section 2.4.

Response 4

Comment noted. Native species and non-native adapted species that support wildlife would be included in seed mixes used for final reclamation.

Response 5

Comment noted. It is the determination of the USFS that hacking, although not preferred, may be appropriate mitigation in certain circumstances. As stated in the FEIS, hacking would be done if considered desirable, feasible, and agreeable among us USFS, NDOW, and IMC. The USFS recognizes the difficulties associated with establishing aspen on waste rock dumps. Site selection and planning are crucial to the success of these efforts. Mitigation involving aspen reintroduction into sites that have previously supported aspen; treating existing aspen to improve viability; and riparian area management have been included in Chapter 2 of the FEIS.

Jack Carlson
January 11, 1994
Page 3

6 In the same section, the document states that impacts to cavity nesting habitat would be mitigated by various methods utilizing aspen removed prior to pit or dump construction. The aspen would be placed as the dead and down component or windrowed as wildlife habitat. This concept is very sound and should be utilized as extensively as possible. Specifics of the implementation of this type of activity needs to be included in the planning documents to ensure that it occurs. In regards to this specific activity and to other mitigation plans in the document, we would like to see more detail regarding time frames, location and methods.

In Section 3.2 Physical Environment, in the discussion under the Wildlife heading, our first question pertains to the paragraph on Page 3-45 on aspen habitat fragmentation. The fact that "GIS technology was not adequate to perform the detailed spatial analysis required to analyze the effects of aspen habitat fragmentation" is very unfortunate. Islands of aspen habitat are naturally in a fragmented condition in the Independence Mountain Range and, therefore, do not provide the degree of habitat quality that larger more contiguous aspen stands provide. Any further fragmentation of these isolated stands would logically further reduce their desirability to wildlife species that prefer larger contiguous stands of forest canopy. Not being able to measure this consequence of proposed mining activities puts remaining fragmented habitats in the Independence Mountain Range in jeopardy.

7 On page 3-47, in the discussion on the bald eagle the text states bald eagles "pass through the project area in the winter" Bald eagles are yearly winter residents of the project area and adjacent valleys. Site records of foraging eagles document their activity on both sides of the Independence Range during the winter.

8 Later in the same section in the discussion on western big eared-bats, the text indicates that the bat was not encountered during mist net trapping in the Independence Range. Surveys conducted in 1981 did document western big-eared bats in the Independence Range north of the project area.

9 The last paragraph on page 3-50 discussed Redband trout. The document references a stream survey conducted in 1978. Our agency conducted a survey of the Burns Creek fishery in 1985. The data from the 1985 survey indicated a higher density of fish in Burns Creek and a better trout resource than what is presented in the DEIS. It would seem that this information should be included in the analysis since it presents more recent information than the previous survey. The 1985 survey report is available in our office in Elko.

Response 6

See Response 2.

Response 7

Comment noted. The affected environment section for bald eagles has been revised to reflect that they are winter visitants in Nevada and have been sighted in valleys adjacent to the Independence Mountain Range.

Response 8

Comment noted. Information provided by NDOW to the USFS did not include documented sightings of the western big eared bat in the Independence Mountain Range.

Response 9

Comment noted. This information has been obtained by the USFS and was used to revise the FEIS. See Section 3.3 Biological Environment.

Jack Carlson
January 11, 1994
Page 4

10 On page 3-52, in the third paragraph discussing goshawks, the text discussed goshawk nest 074, 127 and 128. First the text states that the nests are not goshawks nests and then it states that they will be considered as goshawk nests. This part of the narrative is conflicting.

11 On page 3-53 in the discussion of Mule Deer, the description of the mule deer resource is confusing and does not address some of the issues. There is little significance in comparing buck ratios from 1991 and 1992 or the increase in the deer population from 1990 to 1992. The long term trend is alluded to but is not discussed in more detail. Long term trends are much more important to understanding the Area 6 deer resource. The focus of the discussion is about the entire Area 6 deer herd and not the deer habitat located in the project area. It would appear to be more appropriate to document why the project area is important to deer and what role the project area plays in relation to the deer population in the Independence Range and the rest of the Area 6 deer herd. In the discussion on fire, it would be more appropriate to relate this information to the project area.

12 On Page 3-56, Sage Grouse, the document acknowledges the fact that brood rearing areas will be lost under all action alternatives. There is no discussion of the amount of fall and winter habitat that will be disturbed by the proposed action. Upland areas are critical in late summer and fall after the lower elevation ranges become desiccated due to late summer heat and lack of precipitation. The birds will customarily move up in elevation as the summer progresses into fall. Windswept ridges could be utilized as wintering habitat by sage grouse.

13 On page 3-60, there is no mention made of the hoary bat, silver-haired bat, pallid bat, and big-eared bat that exist in and around the project area.

14 On page 3-61, there is no mention made of the importance of the mountain brush/sagebrush grassland habitat type to neotropical migrant birds or wintering song birds.

15 On page 4-33, in the discussion on Effects to Springs and Seeps, the text indicates that if a reduction of flow occurs at Niagara Springs that is attributable to mining, appropriate mitigation measures would be implemented. What type of measures and when would they be implemented? How will the cause of the reduction in flows be determined? Is there some sort of baseline to work from?

Response 10

Comment noted. The narrative text on goshawks has been rewritten for clarification. See Section 3.3 Biological Environment.

Response 11

Comment noted. Text of the EIS on mule deer has been revised to reflect these concerns. See Section 3.3 Biological Environment.

Response 12

Comment noted. Brooding habitat was identified during scoping as the limiting type of habitat for sage grouse within the Project area. Discussions in the EIS focus on this habitat. Effects to fall and winter habitat are not directly discussed, however, many of the on-site and off-site mitigation measures, including final reclamation activities would partially mitigate effects to fall and winter habitat.

Response 13

Comment noted. Information available to the USFS has been reviewed. The FEIS has been revised to state that the hoary and silver-haired bat exist in the vicinity of the Project area.

Response 14

Comment noted. The FEIS has been revised to state importance of this habitat.

Response 15

Approval of any POO by the USFS does not authorize a mining company to infringe upon the water rights of other parties. Water rights and their administration are the authority of the Nevada State Engineer's Office. Presently, the area is in the adjudication process. Flows from springs that would be covered by waste rock dumps would be relocated to the downstream side of the dumps using trench drains or the under-dump drainage systems.

Jack Carlson
January 11, 1994
Page 5

16 On Page 4-41, in Section 4.3 Biological Environment, in the discussion on Vegetative Diversity, the text indicates the diversity of the vegetative cover in the disturbed areas eventually would be expected to be similar to that of adjacent undisturbed areas. This statement is dependent on the shrub species outcompeting the introduced non-native grass species. Has this concept been documented in the Independence Range on mine disturbances? Is there documentation of shrub succession in grass dominated sites on mine reclamation elsewhere? Work done in Idaho over fifteen years ago has yet to demonstrate successional replacement of introduced grasses and forbs by the native shrub/grass communities.

17 On page 4-46, in the discussion under Wildlife Habitat and Range Resources, the text indicates that during the project changes in vegetation would displace wildlife to neighboring areas. We question the extent of this type of "displacement" movement. Depending on the species, most of the available habitat will be utilized by existing "resident" wildlife. To add additional numbers onto existing populations would increase the demand on the resources supporting the wildlife, ultimately causing the original displaced members to be lost from the population.

18 In the same section, the text talks about secondary succession providing habitat for wildlife requiring older age classes of vegetation. This statement is very important from a reclamation planning standpoint. Certain habitat conditions are extremely important in Jerritt Canyon. For example, the slopes, exposures and vegetation are the factors that made the area important to mule deer. It appears that these factors are not fully considered in designing the final configurations for the planned disturbances. Much of the surfaces that are planned to be revegetated are the flat dump surfaces.

19 In the next section on Reclamation Potential, the text again states, "Over time, the diversity of the vegetative cover in the disturbed areas is expected to be similar to that of adjacent undisturbed areas." In light of the previous discussions on plant succession and habitat design, we wonder if this statement is accurate. Are there examples on the mine site where this phenomenon is occurring? The design of the dumps does not appear to create similar physical characteristics. Succession will be in large part dependent on the physical construction of the site and the type of vegetation that is placed on the site.

20 On page 4-60, in the discussion on Mule Deer, the final sentence states that reclamation practices will be utilized that will benefit mule deer. The best practice that could benefit mule deer in this plan would be to design the dumps so that they could be revegetated to approximate the preexisting habitat in Jerritt

Response 16

Comment noted. Establishment of shrubs, including sagebrush, bitterbrush, and rabbittbrush on reclaimed mine disturbances has been documented at Jerritt Canyon. These species have been seeded, planted, or invaded naturally. This establishment represents the early stages of succession. It is expected that with proper planning, upland shrub communities can successfully be established. Post-mining land configuration for the various alternatives include slopes of various aspects and steepness. In addition, depth of growth medium would generally be a minimum of 8 inches with some areas having varying depths. Topographic variation along with different combinations of soil and plant conditions would result in a mosaic of vegetative communities over time.

Response 17

Comment noted. The FEIS has been revised to address this concern.

Response 18

Comment noted. See Response 3 and Response 16.

Response 19

Comment noted. See Response 16.

Response 20

Comment noted. See Response 3 and Response 16.

Jack Carlson
January 11, 1994
Page 6

Canyon. Revegetated steeper slopes, south exposures, and mountain brush/sagebrush plant communities are the types of features that will benefit mule deer.

21 On page 4-63, in the discussion under Golden Eagles and Other Raptors, the text states that the majority of the area would be revegetated once mining operations cease. This is not an accurate statement. By using the totals from Table 2.2, the only Alternative that exceeds 50% of the disturbance being revegetated is Alternative D. All of the other action alternatives show less than 50% of the total disturbance being revegetated. The next best alternative is Alternative E with 49% of the disturbance planned for revegetation.

22 The discussion on raptors should include some analysis on the loss of prey producing habitat and its effect on the short and long term viability of raptor populations in the analysis area.

23 On the same page in the next paragraph, the document indicates that some raptor species will see a decrease in population and others may see an increase. Is there some documentation available to indicate what species will see a population increase? If so this should be included in this statement.

On page 4-63, in the discussion on Upland Game Birds, the document states habitat losses would be minor. Forest grouse habitat in the entire range is naturally fragmented and each segment may support independent populations or may be links between populations. Loss of additional limited habitat could compromise the ability of the already fragmented populations of forest grouse. This could add to the length of recovery of the populations of not only forest grouse, but the hungarian partridge and chukar populations being impacted by the proposed action as well.

24 On page 4-64, in the discussion of Furbearers and Predators, the text again discussed displacement of animals onto adjacent undisturbed areas. We suggest that these "displaced" individuals may be lost to the population as a result of the proposed action. Suitable habitat that is presently undisturbed will generally have individuals utilizing all of the available habitat. This is particularly true in the case of large predators. Another factor that will be effected by the proposed action is the change and reduction in the prey base supporting the predators. The proposed action will reduce the amount of prey available to the predators, with a probable reduction in the predator population.

25 One fact not included in the document is the loss of a mountain lion den to the New Deep pit. The rock pinnacle on the knob on the west ridge of the New Deep pit was an active lion den site in 1989.

Response 21

Comment noted. Changes have been made to the EIS text to reflect actual percentages of area that would be revegetated.

Response 22

Comment noted. The loss of prey producing habitat is discussed in the FEIS. The loss of prey producing habitat may affect individual raptors as discussed in the document.

Response 23

Comment noted. No information on which raptor species may see an increase is available.

Response 24

Comment noted. Changes have been made in the FEIS to address this concern that displaced individuals may be lost to the population.

Response 25

Comment noted. A review of information provided by NDOW indicates that a feline den in the New Deep area was active in 1989, but the species of animal was not identified. Additional information supplied by IMC shows that this den was used in 1993 and 1994 by mountain lions. The FEIS has been revised to state that this den would be lost by development of the New Deep open pit.

Jack Carlson
January 11, 1994
Page 7

In the same section, the text indicates that once mining activity ceases, mountain lions may return to Jerritt Canyon. Since the lion population is dependent on mule deer as their primary prey species, the overall density in Jerritt Canyon will largely be dependent on the availability of deer. Providing habitat for the prey species, as discussed in the document, will entail providing habitat for mule deer.

26 On page 4-65, in the discussion on Other Species, the first paragraph indicates that available habitat for bats may be increased as a result of pit construction. The very next statement says that the existing pits do not appear to have sites that meet the criteria to be suitable for roosting. These two statements are contradictory and need to be reconciled. In addition, all of northeastern Nevada's bats are insectivorous. In general, insects rely during some period in their life cycle on vegetation for structure or forage. The creation of a few "cracks and holes or exposure of solution cavities in pit walls" will probably not have a positive effect on the local bat populations if 2,600 acres of their foraging habitat is eliminated.

Breeding migratory bird populations have averaged 2.96 birds per acre in sagebrush/grass/mountain brush communities in northeastern Nevada similar to those in the Project Area. Also, breeding migratory bird populations have averaged 3.03 birds per acre in mixed deciduous/coniferous forests in the west similar to those in the Project Area. Table 1 gives an estimate for potential losses of breeding birds in the project area if Alternatives B, C or F are pursued (Existing disturbance not included).

Table 1. Effect of Jerritt expansion on local breeding bird populations.

	Migratory/Breeding Bird Habitat Loss (Proposed Acres) (By Alternatives)		
	B	C	F
Mountain Brush/Sage brush/grass	1,918	1,996	1,150
Mixed Deciduous Forest	641	666	627
Total Habitat Loss (acres)	2,559	2,662	1,777
Total Predicted Bird Losses	7,619	7,926	5,304

Response 26

Comment noted. The FEIS has been revised to address this concern.

Jack Carlson
January 11, 1994
Page 8

27 Further down in the same section, the text indicates that rabbits would be displaced by the mining activity. Again we question whether there is available habitat for these additional individuals to be displaced to.

28 Losses to local migratory breeding birds could be significant. Therefore, statements like the one offered on 4-66 "Generalistic species and those associated with more abundant and widely distributed plant communities would not be appreciably affected", are inaccurate. If Alternative F was chosen, Jerritt Canyon would loose approximately 5,300 migratory breeding birds. Related to these comments, there appeared to be no analysis of the species composition of neotropical migrant breeding birds, non-breeding migrant song birds, or wintering song birds in the project area. Breeding bird analyses just a few canyons north of the project area, for example, documented 39 species in 1991.

29 On page 4-66, the document states "Results of aspen planting in the Independence Range are inconclusive." This is a very important statement. This document has made several references to aspen planting for mitigation for numerous resources. It seems that there may be a question as to the effectiveness of this activity. In many cases alternatives to replacing aspen have not been explored in this document.

30 The Alternative that appears to be the best for wildlife would be Alternative F. The use of underground mining techniques to mine the New Deep deposit would greatly reduce the surface impacts to wildlife habitat. Of the remaining alternatives that entail surface mining of the New Deep deposit, Alternative E would appear to be the best for wildlife. The level of reclamation with this alternative would provide the greatest benefit to wildlife with the smallest trade off on the amount of and type of habitat being impacted. Certain aspect of Alternative E could provide benefits to wildlife if selected in concert with aspects of other action alternatives. The movement of the waste rock dump from the west side of the New Deep pit to the drainage due south of the New Deep pit would provide less disturbance in high value mule deer winter range. Combining this step with decreasing the amount of flat tops on the dumps would provide a much more suitable site for deer following the end of the mining activity. Increasing the amount of slopes that can be reclaimed would also provide more benefits to wildlife. This could be accomplished by reducing the steepness of the slopes on the dumps to angles of 2:1 as opposed to angle of repose. The additional acreages disturbed would be offset by the eventual reclamation. Another compromise that would provide more benefit to wildlife would be to use the reclamation plans for the Saval/Steer waste dumps from Alternative E with the preferred alternative. This would increase the acreage of reclamation that would be accomplished providing additional habitat for wildlife.

Response 27

Comment noted. The FEIS has been revised to address this concern.

Response 28

Comment noted. The FEIS has been revised to address this concern.

Response 29

Comment noted. Re-establishment of aspen on dump sites would be conducted on an experimental basis. Off-site alternatives for aspen replacement have been explored and are discussed in Section 2.6, Management, Mitigation, and Monitoring, of the FEIS. IMC will work with the USFS in three areas: aspen re-introduction, aspen stand improvement, and riparian area management.

Response 30

Comments noted.

Jack Carlson
January 11, 1994
Page 9

If you have any questions or comments concerning this input, please contact me in Elko.

Sincerely,

Duane Erickson

Larry Barngrover
Manager, Region II
1375 Mountain City Highway
Elko, NV 89801
(702) 738-5332

DE
cc: Habitat Bureau
Russell Dailey, Area Manager, Elko Resource Area, BLM
Doug Zimmerman, Chief, Bureau of Mining Regulation and Reclamation, NDEP
Scott Lewis, Independence Mining Company
Region II
File

Letter #15

The Wrights
HC 32, Box 180
Tuscarora, NV 89834
(702) 756-6561

January 17, 1994

Mr. Jack Carlson
District Ranger
Mountain City Ranger District
P. O. Box 276
Mountain City, NV 89831

Attn: Mr. Don Carpenter

Mr. John Inman
Forest Supervisor
Humboldt National Forest
976 Mountain City Highway
Elko, NV 89801

Re: Jerritt Canyon Mining Expansion

Dear Sirs:

I have reviewed the Draft Environmental Impact Statement (DEIS) for the Jerritt Canyon Mine Expansion Project by Independence Mining Company. I find many of the items within the DEIS either understudied or ignored completely. Listed below are my comments and references to the particular portions of the DEIS which cause me particular concern:

1 1. On page 4-23, the last paragraph reads "Most of the precipitation and run-off intercepted by the pit would recharge the local ground water system by infiltration through the fractured rock in the bottom of the pits. This recharge may surface downstream of the pit as supplemental flows to streams, seeps, and springs." It is my feeling that, yes, this water is certainly going to infiltrate the fractured rock, but most likely as has been the case in Burns Basin, it will not surface again. What evidence do you have to show it will resurface?

2 2. On page 4-33, in the last paragraph it reads, "over the last ten years, flows from Niagra Spring have varied between 300 and 8620 gallons per minute." In the 41 years our family has been ranching on this property, a flow as low as 300 gal/min. has never been observed. The only time a recording like this could have occurred was when we were diverting water above the measuring

Letter #15
Jay Wright

Response 1

Groundwater flow patterns are considered to be complex since they are controlled by unseen geologic features. Assuming that the Independence Mountains are considered as a recharge area for groundwater in the Independence Valley, then it is assumed that water would eventually contribute to the surface flow of the South Fork of the Owyhee River. This is also stated in Eakin's 1962 report titled "Groundwater Reconnaissance Series, Report #8, Groundwater of Independence Valley, Nevada". A tracer study conducted in Burns Basin during 1985 indicated that there is a connection between the karst system underlying the pit and Burns Creek near the Forest boundary, as indicated on page 3-24 of the DEIS.

Response 2

Comment noted. The FEIS has been revised to show adjusted flow rates at Niagara Spring of 1,523 gpm low flow to 9,337 gpm maximum flow with a mean flow of 3,361 gpm.

Mr. Jack Carlson
Mr. John Inman
January 17, 1994
Page two

device into a pipeline to feed our hydro-electric generator. Therefore, we feel that this minimum flow number should be changed to reflect the actual flow rates of Niagara Spring.

3

3. On page 4-69, paragraph 5, concerning livestock grazing in Jerritt Canyon, the last paragraph reads: "Under any of the action alternatives, the closure of one unit could be anticipated for this allotment, representing a 50% reduction of AUMs." It is our feeling that given the huge amount of disturbance in Steer Canyon and Jerritt Canyon in terms of pits and waste dumps, along with the miles of exploration roads between Wright Window and New Deep on the north side of Jerritt Canyon that a 50% reduction is conservative. I am not sure that a workable management plan for the remaining area can be developed. Another concern we have is that if some or all of our grazing priviledges are denied in Jerritt Canyon for a period of 5 years our stockwater rights on all or part of this allotment will be lost according to state law. I am wondering why the DEIS does not address this issue?

4

4. On the picture board we brought to the January 5, 1994, Public Meeting in Elko, it showed a stream running grayish black water, yet no mention of such conduct appears in the DEIS. We first observed the discolored water flow on August 10, 1993. Over the next 2-1/2 months, every time we went by this stream, it appeared just as it does in the picture, copy enclosed. On one occasion, I went on up the canyon to find out where all the sediment was coming from. I found it was coming from a drill rig operating in Trough Canyon. As far as I could see, there were no steps being taken to try and control this problem. Why aren't problems like this one more closely monitored? How are you going to change the procedure to monitor these things?

Conclusion

I am not opposed to mining activity. However, I believe that as fellow users of public land, Independence Mining Co. should accept responsibility for the adverse affects their actions will cause. I am disappointed with the DEIS, it seems to have been written from IMC's point of view. In the final EIS, I would like to see a truly objective study done, independently of any mine influence. I ask the Forest Supervisor to look at this proposal very carefully, and if the concerns of the ranches directly affected by this expansion are not met, to approve the NO ACTION alternative.

Sincerely,

Jay Wright

Jay Wright

Response 3

Comment noted. Since release of the DEIS, the USFS has reassessed potential impacts to the Jerritt Canyon Cattle and Horse allotment. Complete closure of the Jerritt Canyon Unit would be done only if the New Deep ore body were mined using open pit methods. The closure of this unit would result in a 63% reduction of animal months. If Alternative F were selected, partial closure of the Jerritt Canyon Unit would be implemented. The maximum reduction would be 29%. Under Alternative F, a workable operating grazing plan is feasible for the Jerritt Canyon Unit and the remaining two units of the Jerritt Canyon Cattle and Horse allotment.

Response 4

Comment noted. Even though exploration is beyond the scope of this project, water monitoring procedures for mine activities are included in Appendix B. As part of the POO, there is a Quality Assurance/Quality Control program which also lists additional monitoring and inspection procedures to prevent or reduce a situation like this from occurring.

Letter #16

The Wrights
HC 32, Box 180
Tuscarora, NV 89834
(702) 756-6561

January 17, 1994

Mr. Jack Carlson
District Ranger
Mountain City Ranger District
P. O. Box 276
Mountain City, NV 89831

Attn: Mr. Don Carpenter

Mr. John Inman
Forest Supervisor
Humboldt National Forest
976 Mountain City Highway
Elko, NV 89801

Re: Jerritt Canyon Mining Expansion

Dear Sirs:

I have reviewed the Draft Environmental Impact Statement (DEIS) for the Jerritt Canyon Mine Expansion Project by Independence Mining Company. I find many of the items within the DEIS either understudied or ignored completely. Listed below are my comments and references to the particular portions of the DEIS which cause me particular concern:

1 1. On page 3-15 it states the following precipitation levels: Upper sub-basin - 26" precipitation average, Lower sub-basin - 18" precipitation. Steer and Saval are in the upper sub-basin where winter snow falls into Aspen stands. These aspen stands protect snow from sunlight and wind and are vital to providing late season water irrigation to the Wright Ranch. The DEIS states 640 acres of Aspen will be disturbed. North Jerritt is also upper sub-basin with 26" of average precipitation now proposed for mining. New Deep will cause additional disturbed areas and loss of late season water irrigation. The DEIS documents do not fully address how these upper sub-basin disturbed areas will restrict the irrigation water to the Wright Ranch or calculate the full economical impact to our ranch.

2 2. The idea of waste rock dumps absorbing run-off water more rapidly than natural slopes is hard to believe (see page 4-22, paragraph 3, page 4-23, paragraph 2). This statement is just not accurate. Thousands of sagebrush and the abundance of grass and shrubs are the ideal natural way for the absorption of run-off. This statement is just not accurate.

Letter #16
James Wright

Response 1

Comment noted. Please refer in the DEIS to page 4-22, Table 4.5 "Change in Pre-Mining Condition Runoff by Alternative". This table displays predicted changes in total annual runoff.

Response 2

Comment noted. Based on observations and field analysis, the USFS has found that armored angle of repose dump slopes and ripped dump surfaces do allow for the infiltration of surface run-off.

Mr. Jack Carlson
Mr. John Inman
January 17, 1994
Page two

3

3. Comment on page 4-23, paragraph 3. Dusting of snow by mining is a very real issue. Dust is created year long by blasting, haul trucks and drilling. For example, on Monday, January 3, 1994, dust by haul trucks was observed. Even frozen roads when traveled frequently tend to create dust. Common knowledge tells us that snow constantly covered by dust will melt more rapidly. The DEIS should be reworded to clarify the true effects mining will have on the timing of run-off. There will be more than limited dusting of snow in the Saval and Steer Canyons when mining commences. Additionally, all alternatives other than Alternative A will likewise affect snowpack by dusting from New Deep mine in the north fork of Jerritt Canyon. My direct observation of the sidehills in Mill Creek in the winter of 1992 support my views of the significant snow dusting problem.

The studies included in the DEIS showed little effect of dust on snow melt. But, as Scott Lewis indicated at the Elko Public Meeting, this study was conducted for a period of only one year. Baseline data as important as this cannot be collected in one year. There are so many variables from year to year affecting snow melt. Temperatures vary affecting snow melt as well as location and amount of the snowpack. All have an impact on the rate of snow melt. With so many variables affecting snow melt, I feel a longterm study needs to be conducted to truly get a more reliable measure on the effect dusting has on snow melt. I think you will find, as we have, that dusting does have a significant effect on the rate of snow melt. I feel data should be collected from several sites in the proposed mine expansion area, not just one in particular area; otherwise the DEIS fails to adequately address our concerns in accordance with the applicable rules, regulations and statutes of NEPA.

4

4. I asked Jack Carlson, the District Ranger, if the public comments would be subject to the Freedom of Information Act. I did not want Mine officials around Forest Service personnel when writing the final EIS. Mr. Carlson did not know the answer. Please include a full discussion of how IMC interacts with USFS in preparing responses to DEIS comments.

5

5. At the Public Meeting in Elko on January 5, 1994, Clive Bailey of Horizon Resources, who is doing reclamation work, asked a question about dump stability and out of the corner of my eye watched Scott Lewis from IMC and Larry Randall of the Forest Service. They gave each other the eye and moved right in on the discussion. So, it appears to me the Forest Service is unduly influenced or controlled by IMC personnel. We are nervous about the huge dumps built above us in Jerritt Canyon. Forest Service

Response 3

We concur with the statement that dust covered snow would absorb more short wave radiation and melt faster than undisturbed fresh snow. On a large scale, this would affect the time to peak discharge in a watershed. In the case of the Jerritt Mine, this situation does occur but for the most part only in relation to the snow associated with or adjacent to the haul roads. In fact, placement of haul roads is such that snow deposition is augmented by 4-6 feet high berms which act as snow fences. Flat dump surfaces would also tend to be snow deposition and accumulation areas. The large snow piles created during snow removal from haul roads also tend to melt more slowly than snow on undisturbed areas, which prolongs flows over a longer time period. This may actually augment the snow retention in the watershed, augment runoff, and shift the peak discharge.

Response 4

IMC and USFS personnel must communicate with each other in order for existing plans to be effectively administered and for information to be conveyed regarding the proposed actions. The USFS is entirely responsible for the EIS, but relies in part on information submitted by IMC and various subcontractors. As such, preparing the FEIS requires communication with IMC and others for more data or clarification regarding specific questions raised on the DEIS.

Response 5

Comment noted. The Forest Service cannot ascertain exactly what concerns the writer is referring to. The FEIS analyzes the impacts to the human environment from constructing the waste dumps in Jerritt Canyon, and these impacts are displayed in the FEIS. Dumps would be designed and constructed to ensure stability, therefore, waste dump failures are not expected.

Mr. Jack Carlson
Mr. John Inman
January 17, 1994
Page three

personnel told Mr. Bailey at the Elko meeting they also have real concerns about living below those dumps. Yet, the DEIS does not discuss those concerns.

Conclusion

6 The New Deep and Saval-Steer mining projects in Jerritt Canyon will have a major impact on the water for the Wright Ranch irrigation system and grazing system. I feel these are legitimate concerns which are not adequately discussed in the DEIS. Until the concerns are addressed, I urge the Forest Supervisor to deny the approval of any mining expansion project. Our concerns about the proposed expansion are based on our observation of impacts that the Independence Mining Co. has already had, near Jerritt Canyon.

Sincerely,

James J Wright

James Wright

Response 6

The issues included in the DEIS were based on public and agency comments received during the scoping process. Approval of a POO by the USFS does not authorize a mining company to infringe upon the water rights of other parties. Water rights and their administration are the authority of the Nevada State Engineer's Office.

Letter #17

ANDERSON, PEARL, HARDESTY, LYLE, MURPHY & STONE
ATTORNEYS AT LAW
A PROFESSIONAL CORPORATION
THIRD FLOOR
245 EAST LIBERTY STREET
POST OFFICE BOX 2150
RENO, NEVADA 89515
TELEPHONE (702) 348-5000
FACSIMILE (702) 348-7370

ROBERT EDWARD LYLE
ANDREW PEARL
JAMES W. HARDESTY
ROBERT C. ANDERSON
MARVIN W. MURPHY
PHILLIP M. STONE
TODD A. BADER
BRAD A. CHAMBERLAIN
JONATHAN J. WHITEHEAD
TIMOTHY A. LUKAS
MATTHEW E. WOODHEAD

F.R. BREEN
OF COUNSEL

January 17, 1994

Mr. Jack Carlson
District Ranger
Mountain City Ranger District
P. O. Box 276
Mountain City, NV 89831

Attn: Mr. Don Carpenter

Mr. John Inman
Forest Supervisor
Humboldt National Forest
976 Mountain City Highway
Elko, NV 89801

Re: Jerritt Canyon Mining Expansion

Dear Sirs:

I have reviewed the Draft Environmental Impact Statement (DEIS) for the Jerritt Canyon Mine Expansion Project by Independence Mining Company. I find many of the items within the DEIS either understudied or ignored completely. Listed below are my comments and references to portions and/or omissions of the DEIS which leave me with particular concerns:

Water Quality

1 1. The DEIS fails to address the probable impacts caused on the Wright and VanNorman Ranches by a reduction and timing disruption in the quantity of water to grow crops and to provide water for humans and livestock which the proposed mine expansion will cause.

2 2. The DEIS fails to take into effect the impact of the changes in topography on the watershed in the Jerritt Creek Canyon and Burns Creek Basin. Water flowing in Jerritt Creek Canyon and Burns Creek Basin is a direct result of precipitation in and around the canyons. Should the mine be expanded as proposed it will interrupt the natural stream flow and drainage from this watershed.

Letter #17
Anderson, Pearl, Hardesty, Lyle, Murphy, and Stone

Response 1

Potential impacts to water quantity are addressed in Chapter 4 of the EIS. Potential impacts to surface water are quantified at the Forest boundary for each alternative and compared to pre-mining conditions in Table 4.5. The Wright and Van Norman Ranches are immediately adjacent to the Forest boundary and it was noted on page 4-24 of the DEIS that downstream water users would be affected by the potential changes in water flow. By necessary implication, potential effects described for Niagara Spring would be experienced by the water users of that spring.

Response 2

Comment noted. The pre-mining and post-mining watersheds were taken into consideration in the hydrologic model used to predict effects to surface water run-off. Mine expansion would affect stream discharge and timing of peak flows. Predicted changes in runoff by alternative are displayed in Table 4.5 on page 4-22 of the DEIS.

January 17, 1994
Page two

Interrupted precipitation and drainage will not go into the creeks in the form of run-off or ground water recharge. No one has quantified the reduction in creek flow. This activity directly impacts the priority downstream users of these watersheds. Therefore, the DEIS fails to include a full discussion of the potential consequences and corresponding mitigation measures.

3 3. The DEIS fails to adequately quantify the impact of the proposed mining expansion on Niagara Spring and VanNorman Spring. No studies on ground water flow for these vital springs were conducted. The discussions within the DEIS are either based on mere speculation or wishful thinking on bedrock water effects.

4 4. There is little or no investigative information or data on the impact to surface and ground water hydrology by allowing New Deep Pit to remain exposed after the mine closes. The DEIS fails to discuss or analyze the impact of leaving the pit floor at a water level of approximately 6100 feet after mining ceases and its affect on Niagara Spring and Jerritt Creek Canyon.

5 5. An unknown quantity of water is being directed and/or diverted from the creeks and streams to satisfy exploration, drilling and dust abatement. These diverted uses are in violation of state law, and the DEIS discusses no impacts or studies on downstream priority water right users.

6 6. The DEIS contains little discussion and no study of the impact or loss of spring flow and shallow and deep ground water supplies even though the proposed expansion alternatives will all impact downstream priority users in the Independence Valley including the Wrights and the VanNormans and others.

7 7. The proposed expansion literally destroys the balance of the water shed for the Wright Ranch, yet the DEIS does not address any of the consequences, environmentally or economically concerning the adjacent property owners.

8 8. The DEIS fails to discuss or disclose adequate data or information regarding water recharge to West Independence Valley and/or the Independence Mountains. Were studies done regarding the average annual recharge and discharge for the Independence Mountains or for the Independence Valley?

9 9. The DEIS does not set forth or contain studies or other data quantifying the impact of the substantial soil disturbance from heavy equipment operation, road building and the mining operation, including waste rock dumping and significant surface contour disruption on the water shed and sedimentation in Jerritt Creek and Burns Creek area.

Response 3

A quantitative evaluation of the effects of the proposed mine expansion on Niagara and Van Norman Spring are difficult, if not impossible, to predict given the complex geologic setting of the area. Surface expression of range front faulting and the occurrence of several springs along this structure suggest this fault strongly influences groundwater flow in the area and that the source of the water is from the Snow Canyon drainage to the northeast of the Project area.

Based on detailed geologic mapping and the hydrologic information acquired during exploration drilling in the area between the New Deep pit and the springs, it was determined that effects to spring flow at Niagara Spring was possible but not likely due to the structural complexity of the area and the compartmentalized nature of the groundwater. The maximum impacts to Niagara Springs displayed in the DEIS were based upon the highest predicted inflows into the New Deep pit. Effects to Van Norman Spring are not predicted because the spring is far removed from the proposed mining in a separate watershed. Hydrologic continuity between the two areas is unlikely. Continued monitoring of the two springs would be used to detect changes in flows that are attributable to mining.

Response 4

Effects of the New Deep open pit on surface water sedimentation and runoff were considered in the hydrologic model used to generate the results presented in Tables 4.5 and 4.7 of the DEIS. An evaluation of the potential for water impoundment in mine pits to degrade the groundwater is required by the State of Nevada. Based on the waste rock characterization study results, degradation of water is not expected. Approval of mining below impounded water in the pit would not relieve IMC from complying with other state and federal laws.

Response 5

Approval of any POO by the USFS does not authorize a mining company to infringe upon the water rights of other parties. Water rights and their administration are the authority of the Nevada State Engineer's Office.

Response 6

Refer to Response 2, Response 3, Response 4, and Response 5.

Response 7

Comment noted. Refer to Response 2.

Response 8

Estimates of average annual recharge and discharge have not been made for the Independence Mountains. Expected changes in recharge and discharge in the Independence Mountains due to the proposed action are discussed on page 4-34 of the DEIS. No estimates of recharge in Independence Valley were made by HCI or by Eakin (1962). Eakin estimated total annual groundwater discharge in Independence Valley at 10,000 acre-feet per year (3,000 acre-feet per year by evapotranspiration and 7,000 acre-feet per year by groundwater contribution to streamflow).

Response 9

Comment noted. See Section 3.2 Soil Resources, Section 4.2 Soil Resources, and Table 4-7 Potential Change in Sediment Yield by Alternatives. Undisturbed and disturbed area soil characteristics were considered in the hydrologic models used to predict runoff and sediment yields based on final configurations of disturbed areas after completion of reclamation, as indicated on page 4-28 of the DEIS. Effects on sedimentation from activities during active mining operations were not quantified but were discussed as potential effects that would be controlled by a variety of measures including sediment pond and traps as discussed under the topics of "Drainage and Sediment Control Structures" and "Roads-Drainage Control" in Chapter 2.

January 17, 1994
Page three

10 10. There are no adequate tests or studies of past waste disposal dumps which are now believed to be the cause of acid water drainage. See page 3-28, paragraph 2 of the DEIS.

11 11. The test results done on the possible impact of dumping waste rock upon water quality are not complete. Therefore, the DEIS contains mere speculation on what the impacts will be and does not allow for a full discussion of this issue in accordance with NEPA statutes, regulations and rules.

12 12. On page 3-28, paragraph 2, the DEIS indicates that waste rock dumps cause changes in water quality, yet the DEIS discloses no research or data gathered regarding the possible impacts of the upstream waste rock dump sites and their correlation to acid rock contaminated water. Mr. Carpenter, of the USFS and Mr. Lewis of IMC disclosed on January 4, 1994 at the Elko Public Meeting that no tests have been done on the suspected waste dumps. Why haven't they been done? Will they be done before approval of any expansion project?

Snow Pack Losses

13 13. The DEIS fails to adequately discuss or consider the subject of dust accumulations on the snowpack and the potential for premature melting impacting the timeliness of runoff through the watershed. Traffic dust from the roadways and blasting dust from the vicinity of the mine when it lands on the snowpack provides a heat collector for the sun accelerating the warming of the snowpack increasing the run-off rate and decreasing the snowpack water storage for delayed season irrigation.

14 14. The DEIS fails to take into effect changes to the topography by the creation of dumpsites and open pit mines which result in large open areas where snow melts and runs off quicker, changing the timing and consequences to downstream users and their ability to receive water flows over a longer period of time. Exposure of roadways, pit areas and soils allows warming at an accelerated rate producing increased runoff and evaporation. The cumulative impact is a disruption of the historical and natural run-off patterns within these drainage basins which affects surface and shallow subsurface water to downstream water users.

Vegetation

15 15. During the course of constructing exploratory roads and haul roads, people have observed weeds growing on the roads which create problems for the rest of the natural forage in the immediate vicinity. The USFS and IMC have taken no steps to control or

Response 10

Comment noted. Springs GDSP-10 and MCDS-10 would continue to be sampled and analyzed. Although elevated levels of sulfates have been recorded at these springs, there is no acid drainage at the present time.

Response 11

Kinetic testing of waste rock has been completed. Results of this testing are included in the FEIS. An overview of the waste rock sampling and handling plan (Appendix A) discusses the handling and placement of potentially acid generating material within the waste rock dumps to protect water quality.

Response 12

Comment noted. See Response 10. See also Response 11 regarding studies and methods for presentation of potential acid rock drainage from proposed waste rock dumps.

Response 13

We concur with the statement that dust covered snow would absorb more short wave radiation and melt faster than undisturbed fresh snow. On a large scale this would affect the time to peak discharge in a watershed. In the case of the Jerritt Mine, this situation does occur but for the most part only in relation to the snow associated with or adjacent to the haul roads. In fact, placement of haul roads is such that snow deposition is augmented by the 4-6 feet high berms which act as snow fences. Flat dump surfaces would also tend to be snow deposition and accumulation areas. The large snow piles created during snow removal from haul roads also tend to melt more slowly than snow on undisturbed areas, which prolongs flow over a longer time period. This may actually augment the snow retention in the watershed, augment runoff, and shift the peak discharge.

Response 14

Comment noted. Refer to Response 2. Topography and snow were taken into consideration in the hydrologic model used to predict impacts to surface water runoff, as indicated on page 4-22 of the DEIS. Refer also to Response 13.

Response 15

Comment noted. Continuance of the existing noxious weed control program will be included in the final POO. This program will include conducting surveys for noxious weeds within the mining area and control of any noxious weeds within the mining areas.

remove the weeds yet. These weeds are likely to continue to go to seed and disrupt even further the natural grasses and forage in the area.

16 16. The DEIS fails to discuss the issue of dust on the grass in and around haul roads and downwind areas from the mine and dumpsites. Livestock cannot eat or ingest grasses heavily dusted, thereby reducing the total AUM's even more than disclosed in the DEIS.

Air Quality

17 17. The DEIS fails to address the nuisance created by dust, which invades homes, lifestyles and the property of adjoining property owners such as the Wrights and the VanNormans.

18 18. The leased eighty-seven (87) acres [DEIS, Page 2-6, paragraph 7] required for stockpiling of reclamation materials should be immediately hydro mulched and watered in order to get sufficient growth on the materials to prevent any fugitive dust from emanating from the stockpiles of materials. Any violation of the dust control standards on USFS property should require the cessation of mining activities at the entire site until such time the mining company corrects the problem. An issuance of three cessation notices in any three consecutive months should constitute grounds for permanent cessation of mining activities until the full implementation of this dust control program and more rigorous enforcement of standards. Each and every employee of Independence Mining Company should be required to act and be accountable as an independent dust monitor and any employee not reporting fugitive dust observed by the Forest Service or other governmental entities is subject to immediate termination.

19 19. The DEIS fails to address the impact of airborne particulates on sedimentation of water sheds and creeks within the vicinity of the proposed expansion.

20 20. On page 2-42, paragraph 4, the DEIS states: "Fugitive dust emissions will be monitored visually." Who will do the monitoring? At what level? What sanctions will the USFS employ to ensure that monitoring is accurate and no violations occur? Why does the discussion of the mining operation's fugitive dust problem not address the impacts upon sedimentation, turbidity and runoff?

Economic Impacts

21. The DEIS fails to adequately address, study, gather data, or information concerning the economic impact on the ranches and ranchers most immediately affected by the proposed expansion of the

Response 16

Comment noted. Areas around the haul roads are considered unsuitable for livestock grazing and were used to figure animal month reductions.

Response 17

The homes nearest the mine site are approximately two miles west of the mine. Since the prevailing wind direction in the area is from the west, most of the time any fugitive dust emissions would be carried away from these residences. In addition, larger particulates such as those likely to be visible settle out very near their sources. It is unlikely that any of the larger particulates would be transported for two miles. Fine particulates could be transported that distance, but these particulates are not likely to be perceptible at a range of two miles. Any particulates discernible at nearby homes and property are likely due to local sources in the immediate vicinity and not from the mine. IMC is required to mitigate fugitive dust by applying water and/or chemical suppressants at an acceptable frequency.

Response 18

The existing air quality permits for the mine expansion and the POO specify the measures required for mitigation of fugitive dust emissions. Any new permits would also specify fugitive dust mitigation measures. Monitoring and reporting requirements are also specified in the air quality permits. The enforcement of the permit requirements would be the responsibility of NDEP.

Response 19

To fully address the impact of airborne particulates on sedimentation of watersheds and creeks would require dispersion modeling of particulates deposition. This analysis was not performed because of the exorbitant cost and time involved in such an effort for an issue that was not raised during scoping and which is not essential to a reasoned choice among the alternatives. All alternatives, with the exception of Alternative F, would have similar impacts on particulates deposition. Alternative F would have less potential for particulate deposition since the New Deep deposit would be mined using underground mining methods. Under any alternative, the sediment traps located below the waste rock dumps would serve to filter any dust deposited in the upstream watersheds and which is later washed downstream.

Response 20

The visual monitoring of fugitive dust emissions would be routinely done by IMC personnel and USFS during site inspections in accordance with the requirements of the air quality permits and POO. NDEP could at their discretion inspect the area at any time.

January 17, 1994
Page five

21 Jerritt Creek Mine and Burns Creek Basin, in particular the Wrights and the VanNormans. Instead, the socioeconomic data only deals with Elko County in general when in fact the areas most immediately affected are the ranches named above followed closely by the West Independence Valley/Tuscarora area.

22 22. The DEIS fails to adequately address the socioeconomic impacts caused by the loss of grazing allotments for the Wrights and the VanNormans. The DEIS fails also to study or address the economic disruption of livestock grazing other than listing a conservative loss of AUM's.

23 23. The DEIS fails to study or address the wildlife migration which is being observed vacating the West Independence Mountains and causing damage and disruptions to the Wright and VanNorman Ranches.

24 24. On page s-xii, paragraph 5, "Socioeconomics", the DEIS states there would be a loss in real estate values. However, no such real estate values have been studied with regard to the Wright or VanNorman ranching operations. Table 1.2 on page 1-11 ignores the socioeconomic impacts to the Wrights and the VanNormans even though they are the adjacent property owners to the proposed project and their ranches have been contributing to the economic stability of Elko County for over a century.

The proposed mining operation will devalue the Wright Ranch and have a similar impact on the VanNorman Ranch. See the attached copy of a letter from Lee B. Smith, Real Estate Appraiser and Consultant. Yet, the DEIS completely ignores these direct effects in violation of NEPA statutes, regulations and rules.

25 25. The DEIS fails to address an alternative for the USFS of minimizing environmental impacts to the Humboldt Forest surface resources by removing all waste dump materials to another location out of the West Independence Mountains for storage and/or later reuse. It appears current short-term economic viability is overemphasized and used as an excuse for failing to minimize long term environmental damage. If, the present gold prices are so low that such an alternative is not economically viable, then the project should not go forward until such a time as the requirement of removing all waste dump materials to another site becomes economically viable.

26 26. No studies, data or information address the subject of changes in topography which will prohibit a return to pre-mining economic conditions and what the probable longterm socioeconomic impacts will be after the mining operations cease.

Response 21

There could be some economic impact to ranches adjoining the Project area resulting from potential loss of animal months and water available for irrigation downstream from the project site. The FEIS analyzed the projected animal month losses and the potential water issues.

Response 22

Grazing permits on national forest lands are privileges that are revocable by the USFS without compensation. The EIS discloses potential impacts from the projected loss of livestock forage areas. Partial mitigation of potential impacts may sometimes occur through the reallocation of grazing resources on other allotments. It is HNF policy that grazing permittees who have had their grazing permits canceled because of mining operations or other reasons will retain "preferred applicant" status for forage available for reallocation under the grant process until the expiration date shown on the permit or five years, whichever is greater.

A 50 percent reduction in animal months identified in the DEIS on the Jerritt Creek allotment does not equate to a 50 percent reduction on all animal months held by the allotment permittee. The allotment was evaluated for the FEIS and it was determined that there would actually be a 61 percent reduction in animal months for Alternatives B, C, D, E, and G. By building additional fences in the Project area, there would be a 29 percent reduction for Alternative F. The permittee also holds grazing licenses and permits on surrounding federal lands, both BLM and USFS.

The reduction in animal months may not be permanent. Once reclamation and revegetation have occurred, the USFS will assess the allotment for re-instatement of livestock grazing.

Response 23

Comment noted.

Response 24

Page s-xii refers to actions which would occur in general in Elko County if the No Action Alternative (A) was selected. Refer to Response 21 for additional discussion.

Response 25

An alternative was analyzed in the DEIS that involved less disturbance to the environment, Alternative F. Because of the nature of gold mineralization, factors such as pit size and depth cannot be varied. The ID team analyzed many different alternatives and developed a range of alternatives that are, as required by NEPA, reasonable, implementable, and meet the purpose and need defined for the project. An EIS need not consider every possible alternative, but only reasonable alternatives.

January 17, 1994
Page six

Blasting Effects

27 27. The DEIS fails to address the impact of noise on the adjacent property of the Wrights and VanNormans, particularly from blasting activities.

28 28. The DEIS fails to address the impacts of shock waves to adjacent properties which cause excessive vibrations to structures, cause livestock to stampede and bolt thereby creating the potential for physical injury to human residents of the area and harm to livestock.

29 29. The DEIS fails to address the human psychological and physiological impacts caused by stress resulting from noise, shock waves, dust and potential disruption of ranching operations on the adjacent properties.

Lack of Mitigation Discussion

30 30. The DEIS is totally devoid of any meaningful mitigation standards or requirements to address water quality degradation resulting from acid rock contamination of ground and surface water.

31 31. On page 2-40, the DEIS indicates IMC would have to construct new water developments designated by the USFS to mitigate losses due to an inability to use any water developments on open grazing allotments. What standards will be employed? What are the timeframes to be specified? Who will require the mining company to take such action? What sanctions will IMC suffer if spring water loss is not corrected within 12, 24 or 48 hours?

32 32. The DEIS fails to address or specify the specific mitigation measures possible and necessary for the ranches affected and the standards under which such mitigation should occur. The DEIS also fails to address any required timeliness of mitigation actions.

33 33. On page 2-44, paragraph 7, the DEIS refers to some unknown, vague and unspecified mitigation measures which might be necessary in the event of the disruption of water flows to downstream users; however, there is no specificity whatsoever concerning timetables, schedules or requirements to mitigate the direct impacts to the downstream water users and holders of priority water rights. Nor are there any requirements for the mining company to prevent permanent or total disruption of the ranching operations and their economic viability. Prior to the initiation of mining, the mining company should be required to drill a minimum of two wells on both the Wright and the VanNorman

Response 27

Noise and shock waves were not addressed as an issue of concern in public and agency scoping. Blasting would result in an increase in ambient noise levels at close range, but such effects would be unavoidable if the project were implemented. Because of the steep topography of the Project area and sound-absorbing features of land forms and vegetation, noise levels would drop rapidly with the increasing distance from the project site. The closest ranch houses are about two miles from the proposed Project area. Mine operations have continued in close proximity to livestock grazing in the past.

Response 28

See Response 27.

Response 29

A study or discussion of the psychological and physiological impacts to individual ranchers or adjacent landowners is beyond the scope of this EIS analysis.

Response 30

Based on the results of the geochemical study and with implementation of the waste rock handling plan, degradation of the water is not anticipated. Therefore, the treatment of potential future acid rock drainage from pits is not discussed in the FEIS. Techniques for treating degraded water would vary depending upon the composition of the drainage. Appendix B contains an overview of the waste rock sampling and handling plan.

Response 31

Comment noted. Potential impacts to water developments on open allotments may vary depending on the alternative chosen and the actual disturbance on the ground. The type of mitigation that would be required to mitigate impacts, the timeframes for implementing such mitigation, and sanctions for failing to take corrective action have not been identified at this time. Impacts to water developments would be dealt with on a case-by-case basis.

Response 32

Although mitigation measures are an important ingredient in an EIS, a detailed and complete mitigation plan need not be formulated and adopted as part of the EIS. Final detailed mitigation and monitoring plans are part of the POO. Where available, detailed information on such measures anticipated for the POO has been included in the FEIS.

Response 33

Approval of any POO by the USFS does not authorize a mining company to infringe upon the water rights of other parties. Water rights and their administration are the authority of the Nevada State Engineer's Office.

January 17, 1994
Page seven

properties which could be used at the expense of the mining company in the event stream and/or spring flows are interrupted at any time for more than 24 hours or stream quality degrades beyond recognized federal and state standards.

34 34. There is a lack of specificity in the dust control plan for this project. A specific dust control implementation plan deserves a full discussion and review in the E.I.S. It should include at least the following: (1) the application of chemical dust suppressants at a minimum on one month intervals on all haul roads, exploration roads or unearthed sites exposed by the mining company. Said applications should be in accordance with the suppressant manufacturers' specifications and sufficient in quantity to prevent dust emissions from any surfaces either by vehicular traffic or winds in excess of 12 miles per hour; (2) in the event dust is observed to leave the surface of the roadway and remain suspended in the air for a period of 30 seconds or more at any one given time, activity should cease in that area until such time as the mining company applies water or other dust suppressants to prevent dust from lifting up and leaving in any fashion from the exposed areas; (3) activities should cease at any time a neighbor complains about disruption of their life or impacts upon their property as a result of fugitive dust emanating from the mine site or any of its activities; and (4) activities should cease at any time dust plumes eminent from any location, haul road, exploration road, reclamation area, or soil storage site in excess of 15 feet into the air or a dust plume remains suspended for more than 30 seconds unless IMC applies water and/or chemical dust suppressants.

35 35. The DEIS addresses no mitigation measures or thresholds of concern for sagehen breeding habitat which would contribute to the longterm sustainment of wildlife within the West Independence Mountain Range.

Miscellaneous

36 36. It is the duty of the Forest Service, in accordance with the Code of Federal Regulations, 36 C.F.R. Part 228, to minimize the adverse environmental impacts on the surface resources in the National Forests. The selection of Alternative C and the recommendations contained within the report fail to minimize the adverse environmental impacts on longterm water quantity and quality, air quality, topographic changes and visual aspects of the National Forest.

37 37. The decision matrix being used by the Forest Service is not consistent with the requirements of 36 C.F.R. Part 228 (See Table 2-3). The DEIS recognizes the proposed expansion is dealing with a fragile environmental area and yet the data summarized in

Response 34

The air quality permits already issued to IMC provide for visual monitoring of fugitive dust emissions from haul roads and crushing activities. Any additional permits to be issued by NDEP for the mine expansion also would specify mitigation measures and monitoring reporting, and contingency plans that NDEP may determine necessary to ensure air quality standards are met.

Response 35

Comment noted. The CEA Draft Technical guide has identified thresholds of concern for sagegrouse brooding habitat for both Burns Creek and Jerritt Creek and these TOCs are used in the analysis. See Section 4.3 Biological Environment of FEIS for discussion on impacts to sagegrouse. Suitable on-site mitigation projects were looked for, but were not available. It was necessary to move off-site to find sites for mitigation. Identified sites are located on the East side of the Independence Mountain Range.

Response 36

Comment noted.

Response 37

Table 2-3, Alternative Comparison and Impacts Summary, is not a decision matrix. It is designed to give the reader the general comparison of alternatives.

the DEIS is not a hard look at the potential impacts on water quality and quantity.

38 38. The data and research summarized in the DEIS fails to analyze, inspect and compare the predicted outcomes outlined in the March, 1986 Environment Assessment for the Burns Canyon Mine Operations and the ultimate effects to water flow, water quantity, lack of mitigation, planning and follow through, diminution in the value of the VanNorman Ranch, and disruption to the grazing allotments held by the VanNormans.

39 39. The DEIS at page s-vii, paragraph 3, entitled "3.0 Affected Environment", indicates that personal interviews were conducted by an inter-disciplinary group of resource specialists. Yet, the Wrights and the VanNormans did not participate in such interviews. Therefore, the information concerning the impacts on the Wrights' and the VanNormans' lives, health, economic and physical well being are not included in the DEIS, even though they are directly affected by the mine expansion project.

40 40. The DEIS fails to address the impact upon wetlands that range from 2.89 acres under Alternative F to 3.82 acres under Alternative D. No 404 permit has been issued or received by Independence Mining Company and no such study has been done to grant the proposed expansion. Approval to expand mining operations prior to the issuance of a 404 permit is premature and fails to preserve the environment within the U.S. Forest.

41 41. On page 2-7, paragraph 2, the DEIS indicates the haul roads will be bermed and maintained to insure safe and efficient hauling operations, to reduce dust emissions and to control drainage. A partial inspection of the current haul roads in the subject area shows no such program in effect thus far. If this was a previous requirement for earlier Plans of Operations, why is it not being enforced? Either enforcement requirements and/or the road specifications need greater detail and inspection, and, the mining company should not use the haul roads and/or exploration roads, nor create new ones until all drainage, berms and dust control methods are in place.

42 42. The DEIS fails to address any meaningful control of soil disturbance associated with exploration roads and drill pads which cover approximately 954 acres as described on page 2-7, paragraph 3.

43 43. On page 2-39, paragraph 2, of the DEIS indicates that continued monitoring programs will go on throughout the life of the project. Which monitoring programs will continue and at what time intervals? Who will be provided with the reports?

Response 38

Effects analysis included review and consideration of the impacts described in previous NEPA documents, including the Burns Basin EA. In relation to water quantity issues, Table 4.5 indicates that 96% of total predicted cumulative surface water runoff losses in Burns Basin would result at the close of existing activities. If unmitigated, such a change could affect downstream users, as would any of the decreases in runoff shown on Table 4.5.

Response 39

There were no "formal" interviews with pre-set questions done during the EIS process. The interviews referred to were discussions with numerous individuals on various topics. Formal meetings, open houses such as in Tuscarora, meetings with permittees and other means of communication were utilized to develop the issues included in Table 1.2 and develop background information.

Response 40

Throughout the FEIS there is reference to an analysis of wetlands. Section 2.5 includes alternatives which were eliminated in part due to wetlands. Section 2.6 discusses monitoring and mitigation, which Section 3.3 discusses the existing environment. Impacts are displayed in Section 4.2 and summarized in Tables 4.10 and 4.11. Appendix C contains the proposed Wetlands Mitigation Plan. Section 404 of the Clean Water Act regulates the discharge of dredged or fill material into the waters of the United States and places the jurisdiction of this with the US Army Corps of Engineer's.

Response 41

Comment noted. See Response 18 and Response 20.

Response 42

Exploration roads and drill pads are not part of the proposed action. The control of soil disturbance associated with this work is discussed in separate environmental documents and operating plans for these proposals.

January 17, 1994
Page nine

44 44. The USFS acknowledged at the January 4, 1994 Public Meeting in Elko that the current level of USFS manpower is insufficient to monitor the mine. What steps will be taken to increase inspection personnel? What steps will be taken to increase the number of inspections? How will the inspectors be able to inspect a larger area? Why has the USFS not conducted spontaneous and unsupervised inspections? When will such spontaneous and unsupervised inspections start?

45 45. On page 3-9, the DEIS indicates foundation soils are two feet deep and up to 80 inches in various drainages. Why are reclamation materials only being put back to a few inches when current soil depths are deeper? See DEIS, page 3-10, paragraph 6.

Conclusion

The DEIS indicates at page s-viii, paragraph 1, that the New Deep Pit would be 527 acres in size, the Saval-Steer Pits would be up to 711 acres in size and the area of disturbance for waste rock dumps would range from 730 acres to 1414 acres. Given the size and long term impacts of IMC's proposals, the USFS should not approve any expanded mining activities until the issues raised by these written comments are fully investigated, explored and discussed with hard data to support probable consequences to the environment and adjacent property owners.

We look forward to your written answers to these questions and concerns as well as a timetable for implementation of the necessary research. In light of our review, the suggested date of March 1, 1994 for your final report does not seem consistent with the legislative and regulatory mandates for a thorough analysis and discussion of all significant impacts under NEPA statutes, regulations and rules.

Sincerely,

ANDERSON, PEARL, HARDESTY,
LYLE, MURPHY & STONE

ROBERT E. LYLE

REL/blh

Response 43

Monitoring is conducted periodically by USFS personnel, IMC personnel, and by site investigations by various state and federal agencies including NDEP, NDOW, USFWS, and the US Army Corps of Engineers. Monitoring is conducted on a regular basis as part of the Quality Assurance and Quality Control Program. As part of this program, a weekly self-inspection report is completed by IMC employees which documents activities, site conditions, and planned corrective actions that may be necessary. These reports document active mining areas and conditions; conditions of haul roads, berms and drainage; dust control; waste rock dump conditions for rock catchment trenches and berms, under-dump drainage systems, slopes, and stability; sediment control structure status for embankments, spillways and impoundments; reclamation activity status, safety and fire problems, and mine area trash status. These reports are distributed to the USFS. Water monitoring is conducted on a monthly or quarterly basis depending upon the sampling objectives and locations, as described in Appendix B. Other resource monitoring timelines are in the final POO and various agency permits.

Response 44

The budget and personnel situation of the USFS is beyond the scope of this analysis.

Response 45

The discussion is Section 3.2 "Soil Resources" talks about soil suitability and soil salvaging operations. Section 4.3 "Soil Resources" discusses the short-term and long-term soil productivity losses that would occur.

RECEIVED
JAN 05 1994

Lee B. Smith and Associates
REAL ESTATE APPRAISERS & CONSULTANTS
LEE B. SMITH, MAI, ARA

2) 883-8008

117 EAST LONG STREET
CARSON CITY, NEVADA 89706

January 3, 1994

Mr. Robert E. Lyle
Attorney at Law
245 E. Liberty
Reno, NV 89501

RE: MINING IMPACTS ON RANCH VALUE

Dear Mr. Lyle:

The following is a response to your inquiry regarding possible impacts of mining on value of the Wright Ranch in Tuscarora, Nevada. The mentioned mining impacts are:

a. U.S. Forest Service Grazing Permit

(1) Reduction in AUM's

(2) Change of allotment

b. Reduction in surface water flows for irrigation

c. General mining operations

Ranch values in Nevada are directly related to available forage expressed in carrying capacity. Possessory interests in U.S. Government grazing permits, U.S. Forest Service, BLM, etc., are marketed with ranch units or sold individually. If marketed with a ranch unit, their value is inherent in the value of the whole ranch. A change in AUM's directly affects carrying capacity and value. A change of allotments can also affect value depending on the increase or decrease in costs to manage and use the allotment. The quality of the allotment and time of use may also have an impact on the ranch operation.

Reduction in surface water flows for irrigation would result in a direct reduction in forage production and carrying capacity. The reduction in forage production may be greater or less than the reduction in the amount of water. The timing of the reduction in the amount of water is a factor. The crops irrigated (alfalfa, meadow, and pasture) would be impacted differently. If the reduction resulted in the inability to sustain an alfalfa stand requiring conversion to a less productive crop such as grain or meadow, the forage production difference could be substantial. If this affects the ranch's balance requiring purchase of hay or reduction of the year-round cow herd, value may be affected beyond the reduction in forage production. If

Mr. Robert E. Lyle
January 3, 1994
Page 2

greater reliance is placed on irrigation wells to make up the surface water loss, the increased cost of energy will reduce the net income of the ranch, resulting in a loss of value.

There are numerous ranches in Nevada County existing with mining operations. The primary change to the ranches because of the mines is increased management and labor of varying degrees. Disruption of historic livestock flows and grazing patterns requires extra livestock management. Increased vehicle traffic and access to remote areas requires additional vigilance. These increase the costs of operation. These items are often mitigated by the mines with the ranches through new improvements, water development, road construction, or purchase.

If you have any questions, please call.

Sincerely,

Lee B. Smith

LEE B. SMITH, MAI, ARA

LBS:vld

SUMMIT ENGINEERING CORPORATION ™

Letter #18

January 17, 1993

Mr. Jack M. Carlson
District Ranger
Humboldt National Forest
Mountain City Ranger District
Post Office Box 276
Mountain City, Nevada 89831

Re: Jerritt Canyon Mine Expansion
Draft Environmental Impact Statement

Dear Mr. Carlson:

The following comments have been prepared on behalf of the Wright Ranches and the Van Norman Ranches.

I have worked with water planning and permitting issues through out Nevada for ranching, mining, municipal, commercial, governmental and individual interests since 1975. During the past two years, I have been preparing cultural maps for eleven ranchers in the South Fork and East Fork of the Owyhee River drainages. The Owyhee River and its several forks are tributary to the Snake River. The States of Nevada and Idaho are requiring all water users of the Snake River Drainage to quantify the amount of water being diverted and identify where these waters are being placed to beneficial use. Both Nevada and Idaho are party to a memorandum of understanding which is being monitored by the federal district court with jurisdiction over the adjudication of all water uses in the Snake River drainage. The due date for filing water right claims for Nevada water users in support of the Snake River adjudication is June 15, 1994.

The draft environmental impact statement (EIS) only addresses water quantity and quality issues within the designated mine study area. Potential impacts caused by the proposed expansion outside the mine study area have not been address adequately.

I have several comments in regards to the draft environmental impact statement prepared for the Jerritt Canyon Mine expansion.

5405 Mae Anne Avenue • Reno, Nevada 89523 • (702) 747-8550 FAX (702) 747-8559
115 East Reno Avenue, Suite 2 • Las Vegas, Nevada 89119 • (702) 736-1801 FAX (702) 736-0542
607 South Fifth Street • Elko, Nevada 89801 • (702) 738-8058 FAX (702) 738-8267

Surface Water

The existing and proposed Independence Mine activities are located in the drainages of Snow Canyon Creek, Jerritt Canyon Creek, Dry Creek, Mill Creek and Burns Creek. These creeks are tributary to the South Fork of the Owyhee River. All of these creek and river surface water sources have vested water rights and permitted water rights in the name of downstream users. Many of these rights have priorities dating back to as early as the 1870's. Springs and seeps within these drainages have vested water rights for stockwater also dating back to the 1870's.

AREA OF CONCERN #1 -

1 The draft EIS must include an itemization of the vested and permitted water rights appurtenant to the South Fork of the Owyhee River in order to determine the impacts to existing water rights. Documentation of these vested water rights is required to be filed with the Nevada State Engineer on June 15, 1994. Permitted water rights already on recorded can be researched at the Nevada State Engineer's office in Carson City, Nevada. This draft or the subsequent final EIS cannot assess the impact to existing water rights without a complete itemization of the vested and permitted water rights in the Independence Valley area.

AREA OF CONCERN #2 -

Based on research at the Nevada State Engineer's office and review of the draft EIS supporting data, Independence Mine does not own surface water rights in the South Fork of the Owyhee River drainage. The draft EIS states that reduction in or consumption of surface water flows are expected.

2 How can Independence Mine mitigate reductions or consumption of surface water when downstream water right owners have senior irrigation water rights dating back to the 1870's?

Impacts to senior surface water owners extend beyond the Jim Wright and Van Norman Ranches located immediately downstream of the draft EIS study area. The Ellison Ranch receives stream and spring water from Snow Canyon Creek, Jerritt Canyon Creek, Niagara Springs, Dry Creek, Mill Creek, Van Norman Spring and Burns Creek. In addition, these streams and springs are tributary to the South Fork of the Owyhee River which is also utilized by the Ellison Ranch and the IL Ranch. Reductions in or consumption of surface water impacts existing senior water right owners on the South Fork of the Owyhee River in Nevada, Idaho and Oregon.

AREA OF CONCERN #3 -

3 The draft EIS states that there will be reductions in surface water flows due to increased precipitation infiltration into the waste rock dumps. Hydrologic Consultants, Inc. states that "Surface water runoff will decrease by about 18% due to capture of runoff by all of the existing and proposed pits.". Surface flows have been monitored over several years for baseline data which has been used to support assumptions stated in this draft. The monitoring of these surface water flows consisted of only periodic single event measurements through out the year. Without continuous flow monitoring gauges, periodic measurements must be averaged which does not provide an accurate representation of the surface water flows or volumes from the affected streams and springs.

2

Letter #18
Summitt Engineering

Response 1

Approval of any POO by the USFS does not authorize a mining company to infringe upon the water rights of other parties. Water rights and their administration are under the authority of the Nevada State Engineer's Office.

Response 2

Refer to Response 1. Resolution and mitigation of water rights issues is the responsibility of the State Engineer's Office. IMC currently has permits for groundwater use on the west side of the Independence Range that could potentially be used to mitigate or offset surface water impacts. The maximum potential surface water impact under any alternative to the Independence Valley would be 950 acre feet of water per year, based on our analysis. This represents about 2% of the total water which flows through the USGS gauge located on the South Fork of the Owyhee River near Spanish Ranch. Moreover, the foregoing surface water quantity reductions are expected to be less because precipitation intercepted by pits should enter the groundwater system and discharge to downgradient springs and streams. Continuous flow monitors are presently in operation at Van Norman Springs, Niagara Spring, and at surface water monitoring station BC-3. All other streams are monitored on a monthly basis, and some of the monitoring data pre-dates mining activities. This data provides a baseline against which to measure mining-related impacts to streams.

Response 3

Continuous flow monitors are presently in operation at Van Norman Springs, Niagara Spring, and at surface water monitoring station BC-3. All other streams are monitored on a monthly basis, and some of the monitoring data pre-date mining activities. These data provide a baseline against which to measure mining-related impacts to streams.

Both WESTEC's technical report and the DEIS state that impacts to Niagara Spring could occur for a relatively short period. WESTEC's technical report states that "flow reduction could potentially occur at (spring) GDSP-25, located one mile west of the proposed pit at an elevation of approximately 6,025 feet, and Niagara Spring, located two miles west of the proposed pit at an estimated elevation of 6,000 feet. GDSP-25 and Niagara springs are located below the regional groundwater surface elevation of 6,100 feet and could potentially lie within the cone of depression from groundwater removal at the New Deep pit. It is not known whether there is a hydraulic connection between the New Deep pit area, Niagara Spring and GDSP-25 that would result in spring flow reduction from pit groundwater removal. Preliminary geologic data suggests that there are faults present between the two sites that may act as flow barriers that would limit the hydraulic connection (geologic maps, IMC, 1993 and personal communication, Mike Ward, IMC Geologist, 1993).

The depth of the New Deep pit will be approximately 1,180 feet. The elevation of the bottom of the New Deep pit will be 5,960 ft., based on an expected 140 foot depth of standing water upon completion. The bottom of New Deep pit will be approximately 70 feet lower than the elevation of Niagara Springs (6,030 ft). The New Deep pit will be located within two miles of Niagara Springs. Even though the draft EIS states that impacts to water flows from Niagara Springs are not expected, it is difficult to determine the basis of this conclusion.

What data and/or research was used to determine that impacts are not expected from the completion of the New Deep pit, Saval/Steer pit and Burns Creek pit on Niagara and Van Norman Springs?

AREA OF CONCERN #4 -

4 After researching the data and reports filed in support of this draft EIS, I was unable to determine whether or not the following questions were researched or addressed. The draft EIS does not address these questions adequately.

How will Independence Mine identify mining related impacts to streams and springs without installing continuous flow monitoring gauges to establish satisfactory baseline data for each surface water source?

How can mining related impacts be separated from climatic and geologic changes which also affect stream and spring flows?

Mining related impacts will affect downstream senior water right owners. How will these reductions in flow be mitigated?

Where is the data that confirms the conclusion that minimal impacts to stream and spring flows will result from the proposed mine expansion? What method was used to determine the minimal impacts to steam and spring flows?

Groundwater

AREA OF CONCERN #5 -

5 The report authored by Thomas E. Eakin of the U.S. Geologic Survey in 1962 titled "Groundwater Reconnaissance Series, Report No. 8, Groundwater of Independence Valley, Nevada" states that groundwater contributes to the surface flow of the South Fork of the Owyhee River. It is also evident that the tributary streams and springs such as Snow Canyon Creek, Jerritt Canyon Creek, Niagara Springs, Mill Creek, Van Norman Spring and Burn Creek receive contributions of groundwater to their surface water flows. The draft EIS does not adequately define the amount of groundwater reductions to be caused by the proposed mining expansion. Based on the data submitted to support this draft EIS, Independence Mine has only provided static groundwater level data obtained during mineral exploration. Although Independence Mine has extensive knowledge of the mineralized geology of the mine study area, very little is known or documented about the groundwater hydrology.

3

The DEIS states that "a short term reduction in spring flow could potentially occur at Niagara Spring and spring GDSP-25, both of which probably emanate from the regional groundwater aquifer and are within the estimated cone of depression that could form".

Both WESTEC's technical report and the DEIS state that impacts to Van Norman Spring are not expected because of its distance from the New Deep pit, and the short duration of dewatering expected in the New Deep pit. WESTEC's technical report estimated the extent of the cone of depression due to dewatering of New Deep pit would likely be less than three miles due to the short duration of dewatering expected, the fracture control of the groundwater system and professional experience at similar mine sites.

Response 4

Mining-related impacts to stream flow were assessed using a computer model that looks at precipitation, drainage basin characteristics, and runoff coefficients (CN) for different materials. The model determines the effects to surface water runoff that result from construction of pits that trap runoff and any precipitation that falls into them. It also accounts for changes in soil properties and vegetation types that influence the generation of runoff. Changes in vegetation, soil properties, basin characteristics and other effects due to mining have been incorporated into the model in order to assess impacts to surface runoff.

Mining-related impacts to surface water flow can be separated from climatic changes by evaluating runoff relative to baseline conditions and by monitoring precipitation. Baseline (pre-mining) flow data was collected prior to mining from some streams in the Project area.

The DEIS displays the predicted reductions of stream flow on pages 4-22 through 4-24. Impacts to springs are described on pages 4-32 through 4-34 of the DEIS. The DEIS does not qualify the magnitude of these impacts as "minimal". The methods used to determine impacts to stream flow are discussed on page 4-22 of the DEIS. Also refer to Response 1, Response 2, and Response 3 for additional information.

Response 5

Potential impacts outside of the Project area boundary were examined in the DEIS. Refer to page 4-31 in the DEIS describing an analysis of wells and springs within a three mile radius of the New Deep pit. The FEIS discusses estimated inflow rates (dewatering) for the New Deep open pit and underground mining. These inflow rates range up to 300 gpm. Refer to Response 1, Response 2, and Response 3. Mining of Saval and Steer and expansion of the Burns Basin pit will occur above the groundwater table, as indicated on pages 4-31 and 4-32 of the DEIS. Over 1,800 exploration drill holes were used in conjunction with geological maps and cross-sections to characterize the fracture controlled, bedrock groundwater system.

GeoResearch, Inc. submitted data under a memo to the U.S. Forest Service which includes a map illustrating groundwater surface elevations and estimated flows. This map verifies Thomas Eakin's statement that groundwater is contributing to the surface water flow in the South Fork of the Owyhee River. Why has the potential impacts outside of the mine study area been omitted from the draft EIS?

AREA OF CONCERN #6 -

6 The regional groundwater table has been located at elevation 6,500 feet in Burns Basin mine area, 6,382 feet in Saval/Steer mine area and at 6,100 feet in the New Deep mine area. The elevation of Van Norman Spring is approximately 6,250 feet. The elevation of Niagara Springs and Van Norman Spring are approximately 6,030 feet. The regional groundwater table slope from Burns Creek to Jerritt Canyon Creek is approximately 2 percent. The flow in Niagara Springs is responsive to the amount of precipitation available to the Independence Mountain Range. The groundwater hydraulics are in place for direct communication of the regional groundwater table with the streams and springs downstream of the mine expansion.

None of the data filed in support of the draft EIS documents a lack of hydraulic communication from the regional groundwater table to Niagara and Van Norman Springs. What documentation is the basis for the draft EIS document statement that minimal impacts will be expected to the flows from Niagara and Van Norman Springs?

AREA OF CONCERN #7 -

7 Independence Mine is not alone in focusing their data and knowledge on mineralized geology. Newmont Gold and Barrick Goldstrike Mining Companies in the past have grossly underestimated the groundwater hydrology in their mine areas. Barrick Goldstrike has been dewatering their pit for over a year by pumping 50,000 to 60,000 gallons per minute when they originally expected to pump 4,000 to 5,000 gallons per minute. Newmont after extensive groundwater testing expects to pump 45,000 gallons per minute from the Gold Quarry pit. Independence Mine has not provided satisfactory data or research of the hydrogeologic characteristics of the mine study area to determine the impacts to local and regional groundwater resources. An example of the limited data is demonstrated by the installation and monitoring of only four piezometers in the area of the New Deep deposit.

Hydrologic Consultants, Inc. concluded that the "... degree of fracturing and local hydraulic boundaries ... are not well defined.". What other data and/or research has been utilized to conclude that there will only be 100 to 300 gallons per minute inflows into the New Deep pit from the regional groundwater table?

AREA OF CONCERN #8 -

Alternative C which has been selected as the preferred alternative will result in about 3,099 acres of additional surface area disturbance in the Independence Valley hydrogeographic basin. Based on the estimated annual precipitation of 18 to 26 inches for the proposed project area, the potential impact to surface and groundwater resources range from 4,650 to 6,700 acre feet per year. This amount of water is equivalent to the irrigation of 1,550 to 2,240 acres of harvest crop lands in Independence Valley.

Response 6

Direct hydraulic connection between the New Deep pit and Niagara and Van Norman Spring is unknown. Geologic data suggests that there are faults present between the sites that may act as flow barriers that would limit the hydraulic connection (see comment response #3). As indicated on page 4-33 of the DEIS, if the New Deep pit and Niagara Spring were directly connected, the estimated inflows of 100 to 300 gpm represent only about three to eight percent of the average flow from this spring. The Saval, Steer, and Burns Basin pit bottoms are elevationally higher than Van Norman Spring, as indicated in Table 4.8 on page 4-31 of the DEIS. The New Deep pit is nearly four miles away from Van Norman Spring in a separate watershed. The tracer study conducted in Burns Basin during 1985 (p. 3-24 of DEIS) indicates that the groundwater flow gradient is in a westerly direction.

Response 7

HCI used the Jacob-Lohman equation to calculate inflows to the New Deep pit. Their sources were limited, but included information from exploration drill holes and from existing mining within the Jerritt Canyon area. The limited amount of groundwater encountered in the exploration drill holes is indicative of the hydrologic conditions in the geographic setting of the Jerritt Canyon operations at relatively high elevations above the valley floors where the major groundwater discharge occurs. The existing pits at Jerritt Canyon have not encountered measurable groundwater inflows. In addition, the underground exploration operations of New Deep have crossed several faults and are presently within about 100 feet of the regional groundwater table and have encountered inflows less than ten gallons per minute over the entire length of the decline.

After researching the data and reports filed in support of this draft EIS, I was unable to determine whether or not the following questions were researched or addressed. The draft EIS does not address these questions adequately.

Has Independence Mine placed groundwater test holes into or surrounding the mentioned north-south trending geologic feature which is claimed to control the regional groundwater table or aquifer?

What supporting data or evidence has been utilized to determine that this north-south trending geologic feature is controlling the regional groundwater table? Data or references
8 were not found in the backup material filed in support of the draft EIS.

Has Independence Mine conducted any pumping tests to determine the recharge characteristics and origins of the regional groundwater table?

Has there been any waivers approved by the Nevada State Engineer for groundwater monitoring, test wells and water exploration wells? Copies of waivers and/or results from testing or exploration were not found in the backup material filed in support of the draft EIS.

Have the effects to surrounding and regional groundwater resources based on the mining of the existing eight pits and waste rock dumps been monitored for a baseline comparison?

AREA OF CONCERN #9 -

The direct pumping or the resulting reduction of groundwater resources caused by pit construction is a consumptive use which requires a permit from the Nevada State Engineer. The draft EIS states that Independence Mine has and will mine out perched water tables which no longer supply water to springs and to the regional groundwater table.

9 Have applications been filed and permits approved by the Nevada State Engineer for groundwater resources that have been and will be consumed by existing and proposed pit and waste rock mining activities in Independence Valley?

Drying up a spring constitutes a consumptive use of water. What water rights have been approved on the spring dried up by Independence Mine?

AREA OF CONCERN #10 -

The draft EIS does not include an adequate mitigation plan. Based on the possible impacts to local and regional surface and groundwater resources, the Nevada State Engineer will be required to review and approve mitigation measures. Such a mitigation plan must be submitted to the Nevada
10 State Engineer for determination of it's feasibility and impact to existing water right owners. Due to the uncertainty of mitigation measures required after impacts are occurring, a mitigation plan and possibly permits must be approved prior to finalization of this EIS.

Why is a detailed mitigation plan not included with the draft EIS?

Response 8

There is no reference to a north-south feature in the DEIS or WESTEC's technical report. HCI's report ("Hydrogeologic Investigation of New Deep Deposit and Estimate of Potential Inflows to Pit") mentions geologic structures that could "compartmentalize" groundwater. There is a major north-south trending normal fault that bounds the west side of the Independence Range in the vicinity of Niagara Springs. This fault is typical of those that occur throughout the range. Its displacement has not been determined. No groundwater test holes or other drilling by IMC has occurred on the west side of the fault, although water wells have been drilled by local ranchers. No mining is planned in the area west of the fault. IMC has three monitoring wells in the vicinity of the New Deep pit, from which baseline data was provided and included in Table 3.5 of the DEIS. Airlift recovery tests of the monitoring wells at New Deep were conducted to derive the transmissivity and storativity values presented on page 4-30 of the DEIS. IMC obtained the necessary approvals to develop these exploration holes as water monitoring wells. None of the pits mined to date in the Jerritt Canyon mine area have intercepted the regional groundwater table.

Response 9

A permit has been filed with the Department of Conservation and Natural Resources, Division of Water Resources (Permit #58460 the "Permit to Appropriate the Public Waters of the State of Nevada" allows IMC to appropriate 0.33 c.f.s. (up to 145.5 acre-feet per year) of water from underground sources.

No springs within the Owyhee Drainage Basin are known to have dried up to date as a result of mining activities at Jerritt Mine.

Response 10

Although mitigation measures are an important part of an EIS, a detailed and complete mitigation plan need not be formulated and adopted as part of the EIS. Final mitigation and monitoring plans for resources under the jurisdiction of the USFS are part of the POO. Where available, detailed information on such measures anticipated for the POO has been included in the FEIS.

AREA OF CONCERN #11 -

11 The final EIS for Newmont Gold Company's South Operations Area Project was completed in November 1993, prior to the December 1993 draft EIS for Independence Mine. Newmont's final EIS contains a detailed mitigation plan for impacts to surface and groundwater impacts. Newmont owns several thousand acre feet of senior surface and senior groundwater rights which will be utilized to mitigate impacts. Newmont has an extensive hydrology department which has established several years of baseline data and conducted exploration to identify potential impacts.

Why has the Newmont draft and final EIS been ignored as a guideline during the preparation of the Independence Mine draft EIS?

Surface Water and Groundwater Quality

AREA OF CONCERN # 12 -

12 Welsh Engineering Science and Technology, Inc. (WESTEC) prepared a draft report dated August 17, 1993 titled "Geochemistry Technical File and Working Materials For The Jerritt Canyon Mine Expansion EIS". This report has not been released by the U.S. Forest Service pending their review. I was able to review a copy of this report in the Mountain City District Office. Statements in this report fortify the possibility that levels of acid in surface and groundwater will be increased due to the expansion of the Jerritt Canyon Mine. A ratio of Neutralization Potential/Acid Potential (NP/AP) less than 3 indicates increased potential for acid generation.

Page 3-10 "Evaluations of both total sulfur and pyritic sulfur data indicates that several of the waste rock samples from Saval/Steer area exhibit ratios of less than 3 when total sulfur values were used.".

Page 3-11 "Evaluations using pyritic sulfur data indicate 4 of the 291 New Deep waste rock samples exhibit NP/AP ratios less than 3.".

Page 3-16 "Evaluations of acid base accounting data using only average or weighted average values may be misleading. Portions of the waste rock to be placed in a dump may potentially be acid forming.....".

Page 3-21 Meteoric mobility test results Table 3-10 show pH increasing to 8.5 or above which is the upper limit for the drinking water standard.

Neither this report or the draft EIS identified methods for handling acid potential materials. The WESTEC report stated that "Actual testing and monitoring programs will be described in the final plan of operation.". But a final plan of operations was not included with the documentation supporting the draft EIS.

When will the final plan of operations be available to review proposed testing and monitoring programs?

Without a testing and monitoring program identified, how will this material be handled and

Response 11

The FEIS for Newmont Gold Company's South Operations Area Project is under the jurisdiction of the Bureau of Land Management. The USFS has no jurisdiction by law for that project, and therefore, we were not a cooperating agency. Both agencies follow the National Environmental Policy Act and Council of Environmental Quality regulations 40 CFR parts 1500-1508 in the preparation of EISs.

Response 12

An overview of the waste rock sampling and handling plan (Appendix A) discusses the handling and placement of potentially acid generating material within the waste rock dumps. A summary of the kinetic testing results has also been included in this FEIS.

where will it be placed to prevent elevated acid content in surface water runoff and groundwater recharge?

AREA OF CONCERN #13 -

Surface water and groundwater quality impacts from the 140 foot deep impoundment within New Deep pit have not been adequately addressed. This impoundment is estimated to contain 3,000 acre feet, assuming the area of the bottom of the pit is 19 acres. This volume of water is roughly equivalent to the amount of water required to irrigate 1,000 acres of harvest land in Independence Valley.

13 What data and research has been done to demonstrate the water quality impacts of a 3,000 acre foot impoundment on surrounding surface and groundwater resources?

This impoundment will not have a flow through water source; therefore water quality will continue to decline due to evaporation and concentration. What data or research has been done to determine whether or not there is groundwater flowing through the pit area? What will be the affect of evaporation (Estimated to be 55 inches annually by Hydrologic Consultants, Inc.) on increasing concentrations of water contaminants? How will Independence Mine confirm pit containment water flow migration into and along with the regional groundwater system?

Underdrains and Sedimentation

AREA CONCERN # 14 -

The competency of the waste rock dump underdrains has not been demonstrated by Independence Mine or any other mining operation. The underdrain is an experiment with irrecoverable impacts
14 to water quality and quantity.

Where are there detailed explanations describing methods to mitigate water quantity and quality impacts should the underdrain system degrade over time?

AREA OF CONCERN #15 -

The draft EIS states that the velocity of the water flowing through the underdrains will prevent sedimentation in the cavities within the underdrain. The draft EIS does not address fluctuations in the stream flow velocities and how sedimentation will respond to periodic lower flows.

15 Where can additional data or research results be obtained demonstrating the efficiency of variable flow velocities on sedimentation within underdrains?

Should the underdrains be clogged with sedimentation, will runoff water continue to impound behind the waste rock dump?

Response 13

Under NAC 445.24352 (3), "Bodies of water that are the result of mine pits penetrating the water table must not create an impoundment which: (a) Has the potential to degrade the ground waters of the state..." Based on the waste rock characterization study results, degradation of water is not expected. Approval of mining below impounded water in the pit would not relieve IMC from complying with other state and federal laws.

Response 14

The underdump drain would be constructed using rock which meets coarse and durable specifications. This would ensure that the drain would not physically deteriorate nor lose capacity for flow. Rock determined to be potentially acid generating would not be placed in the underdump drain. Anticipated velocities within the designed underdump drain would be expected to minimize deposition of silts and clays.

Response 15

The pore volume, potential for sedimentation and capacity of the under-dump drainage system were analyzed for the DEIS (Condor, 1993). The drainage system was determined to have an average flow velocity in excess of the minimum velocity required to keep clay and silt sediments in suspension. If the under-dump drain clogged, water would impound on the upstream side of the dump.

Mitigation Plan

AREA OF CONCERN #16 -

16 The draft EIS has not adequately identified local and regional impacts that can be reasonably expected from such a large expansion project. Additional studies must be done to satisfactorily determine the water quality and quantity impacts to areas and interests outside the mine expansion study area. It is obvious that questioned impacts will occur within and outside the mine expansion area.

Local and regional impacts have been identified by Newmont Gold Company's South Operations Area Project final EIS. In addition, previously unidentified local and regional impacts are demonstrating themselves after EIS reviews at numerous existing mining projects through out Nevada.

AREA OF CONCERN #17 -

17 A comprehensive mitigation plan approved by affected parties is mandatory. The general statement noted in the draft EIS 'That if impacts are attributed to mining, appropriate mitigation measures would be implemented.' does not constitute a mitigation plan.

Who will determine the extent of mining related impacts?

What appropriate permits and resources are required to mitigate impacts?

What other private or public entity besides Independence Mine has the resources to monitor and identify mining related impacts in the vicinity of the expansion area?

The questions go on without a comprehensive approved mitigation plan and the resources to implement that plan.

Respectfully submitted,

SUMMIT ENGINEERING CORPORATION

Michael D. Buschelman, P.L.S.
Water Right Department Manager

cc: Jim Wright
Robin Van Norman
Bob Lyle - Attorney for J. Wright & R. Van Norman
Mike Turnipseed - Nevada State Engineer
Elyssa Rosen - Sierra Club

Response 16

Local impacts to water quality and quantity are discussed in Section 4.2 Physical Environment. Also see Response 2.

Response 17

Although mitigation measures are an important component in an EIS, a detailed and complete mitigation plan need not be formulated and adopted as part of the EIS. Final mitigation and monitoring plans for resources under the jurisdiction of the USFS are part of the POO. Where available, detailed information on such measures anticipated for the POO has been included in the FEIS.

Letter #19

The Wrights
HC 32, Box 180
Tuscarora, NV 89834
(702) 756-6561

Januyary 17, 1994

Mr. Jack Carlson
District Ranger
Mountain City Ranger District
P. O. Box 276
Mountain City, NV 89831

Attn: Mr. Don Carpenter

Mr. John Inman
Forest Supervisor
Humboldt National Forest
976 Mountain City Highway
Elko, NV 89801

Re: Jerritt Canyon Mining Expansion

Dear Sirs:

I have reviewed the Draft Environmental Impact Statement (DEIS) for the Jerritt Canyon Mine Expansion Project by Independence Mining Company. I find many of the items within the DEIS either understudied or ignored completely. Listed below are my comments and references to portions and/or omissions in the DEIS which cause me particular concern:

1. On page 1-5 of the DEIS, it states it is the Forest Supervisor who will consider: " U.S.F.S. responsibility under NEPA of 1969 as amended, to minimize possible adverse effects on the quality of human environment, and with consideration for social and economic impacts." However, the individuals and businesses suffering the greatest negative impact by this expansion are given
1 very little consideration in this document in violation of the applicable rules, regulations and statutes of the NEPA.

The DEIS discusses some of the generic effects this expansion has on grazing, water quality, and dump stability. But, the economic effects of the expansion project on the Wright Ranch and the VanNorman Ranch are not discussed at all.

2. The effects from dusting and blasting noise on the human environment as it pertains to the residents on these two ranches is
2 not discussed at all. The blasting presently done in Jerritt Canyon and Mill Creek has been, at times, extremely disturbing. As any person who works with livestock knows, a loud noise, such as

Letter #19
Glynis Wright

Response 1

There could be some economic impact to ranches adjoining the Project area resulting from potential loss of animal months and water available for irrigation downstream from the project site. The FEIS analyzed the projected animal month losses and the potential water issues.

Response 2

Noise and shock waves were not raised as an issue of concern in public and agency scoping. Blasting would result in an increase in ambient noise levels at close range, but such effects would be unavailable if the project were implemented. Because of the steep topography of the Project area and the sound-absorbing features of land forms and vegetation, noise levels would drop rapidly with increasing distance from the project site. The closest ranch houses are about two miles from the proposed Project area. Mine operations have continued in closed proximity to livestock grazing in the past.

Mr. Jack Carlson
Mr. John Inman
January 17, 1994
Page two

blasting at the wrong moment, can be a very dangerous thing. And, having your houses and buildings shaken by blasting does not make for desirable or tolerable living conditions.

3 3. The potential for acid mine drainage is only marginally touched on in several places. Until it can be determined exactly what the short term and long term risks are, the USFS should not allow any proposed mining expansions in the New Deep area. There is already an indication of a water quality problem in this general area, specifically in springs GDSP-10 and MCDS-10. These two springs just happen to flow under waste rock dumps. Therefore, until it can be determined what caused this water degradation problem, the Forest Supervisor should not approve any additional mining activities in this area.

Conclusion

I was born and raised in Elko. Jay's family has been ranching in Elko County for generations. I realize the short term economic benefits that mining has in the form of jobs for Elko and the surrounding area. However, I ask you to evalute the way mining will effect the families who have made their living from ranching in Independence Valley for the last 41 years. Independence Mining Co.'s activities have affected the human environment and the economic viability of our ranch over the years. This proposed expansion project with its cumulative negative impacts will make it difficult if not impossible for us to survive. We wish to preserve our way of life, as we have committed our lives to ranching and continue to live and contribute to the ranching community and to Elko County.

We are asking the USFS to look at the severe and long term impacts this expansion project will have on our economic and human environment and to take appropriate action by denying the proposed expansion alternatives and selecting Alternative A.

Sincerely,

Glynis Wright
Glynis Wright

Response 3

Comment noted. Results of static and kinetic testing of waste rock are included in Section 3.2 Physical Environment of the FEIS. The potential for acid rock drainage and effects to the environment are discussed in Chapter 4 of the FEIS. An overview of the waste rock handling plan (Appendix A) discusses the handling and placement of potentially acid generating material within the waste rock dumps. Based on the results of the geochemical sampling and with implementation of the waste rock plan, degradation of the water is not anticipated. Monitoring of springs MCDS-10 and GDSP-10 would continue and any degradation in water quality would be mitigated.

Letter #20

NATIONAL WILDLIFE FEDERATION

Suite 512 921 S.W. Morrison Portland, Oregon 97205
503-222-1429
Fax: 503-222-3203

VIA FAX
ORIGINAL MAILED FIRST CLASS

January 18, 1993

Jack M. Carlson
District Ranger
Mountain City Ranger District
Humboldt National Forest
P.O. Box 276
Mountain City, Nevada 89831

Re: Jerritt Canyon Mine Expansion Draft Environmental Impact Statement

Dear Mr. Carlson,

Thank you for the opportunity to comment on the draft EIS. It denotes that the proposed action would expand one mine pit and open three new pits to bring the number of pits at the Jerritt Canyon site to eight. We are concerned about significant impacts to the environment stemming from extensive waste rock dumps, the diversion and use of water, and the haul road.

1. Waste Rock Dumps

1 The Independence Mountains have steep topography that drains water rapidly. Our primary concerns are that waste rock dumps will remain stable and will revegetate as quickly as possible to provide habitat for wildlife. The proposed action would result in slopes either at angle of repose or of 2H:1V, with no apparent terracing to stem erosion or to create a landscape more representative of a natural setting. We oppose angles of repose and support the preferred alternative requiring slopes of 3H:1V and terracing in specific locations.

2. Revegetation

2 The adverse environmental impacts of expanding existing mine pits and developing new ones will not be assuredly mitigated unless the Forest Service requires specific revegetation levels on a specific timeline. The DEIS notes that soil productivity results from disturbing land regardless of whether growth medium is applied later. We request that the Forest Service require that at least eight inch growth medium be applied to all

Working for the Nature of Tomorrow®

Response 1

Comments noted. Stability analyses have been performed for the waste rock dumps under normal and earthquake conditions. The waste rock dumps meet or exceed the safety factors recommended by the USFS for waste rock dumps and are anticipated to be stable.

Response 2

Comment noted. Mitigation for alternatives C-G has been revised to address this concern. Growth medium would generally be spread to a minimum of 8 inches on areas to be revegetated. Refer to Section 2.4 of the FEIS. Due to safety, operational, and environmental factors it is not feasible to place growth medium on all disturbed areas, such as pit high walls. The EIS recognizes that these areas represent a long term loss of soil and vegetative productivity. Region 4 standards state that areas no longer needed for mining operations would receive reclamation treatment as prescribed in the reclamation plan within two years.

disturbed sites within the project area to prevent even further loss of productivity. We also request that the Forest Service establish a timetable for revegetation.

3. Use of Water

3 All action alternatives will result in decreased flows in Jerritt and Burns Creek due to the capture of both precipitation and run-off in the mining pits. The DEIS notes that the water collected in the pits would then "recharge the local groundwater system." No apparent method is proposed to ensure that water recharging the system is not polluted by toxic particulates or other substances originating in the pit or from the mining operations. The final EIS should clarify what specific steps will be taken to ensure that the water recharging aquifers is not in fact polluted by the mining activities.

4. Haul Road

4 The DEIS appears to segregate the impact of mining and processing and to contain no systematic analysis or discussion of the haul road. We consider the haul road to be an integral part of the proposed action. If it is not such a part, the haul road is at least a connected action that should be analyzed and discussed both as part of the direct and cumulative impacts of the proposed action.

Thank you for the opportunity to comment. We look forward to the final EIS and record of decision.

Sincerely,

Peter M.K. Frost
Counsel

Response 3

An overview of the waste rock sampling and handling plan (Appendix A) discusses the handling and placement of potentially acid generating material within the waste rock dumps. Based on the results of the geochemical study and with implementation of the waste rock plan, degradation of water is not expected. Under NAC 445.24352 (3), "Bodies of water that are the result of mine pits penetrating the water table must not create an impoundment which: (a) Has the potential to degrade the ground waters of the state..." Based on the waste rock characterization study results, degradation of water is not expected. Approval of mining below impounded water in the pit would not relieve IMC from complying with other state and federal laws.

Response 4

The haul road is a connected action and is described in Section 2.4. Impacts associated with the haul road are included in the cumulative effects analysis for environmental resources with provinces that extend beyond the Project area.

Letter #21

BOB MILLER
Governor

STATE OF NEVADA

JOHN P. COMEAUX
Director

DEPARTMENT OF ADMINISTRATION
Capitol Complex
Carson City, Nevada 89710
Fax (702) 687-3983
(702) 687-4065

January 18, 1994

Jack M. Carlson
Humboldt National Forest
Mountain City Ranger District
P.O. Box 276
Mountain City, Nevada 89831

R e: SAI NV # 9430044 Project: Jerritt Canyon Mine Expansion Draft Environmental Impact Statement

Dear Mr. Carlson:

Attached are the comments from the Nevada Divisions of Minerals and Environmental Protection concerning the above referenced project. These comments constitute the State Clearinghouse review of this proposal as per Executive Order 12372. Please address these comments or concerns in your final decision.

Sincerely,

Maud Naroll

Maud Naroll
State Clearinghouse Coordinator

MN\jbw
Enclosures

Letter #21
Nevada State Clearing House

Letter received after comment period ended. Comments were reviewed and considered.

BOB MILLER
Governor

STATE OF NEVADA
DEPARTMENT OF MINERALS
400 W. King Street, Suite 106
Carson City, Nevada 89710
(702) 687-5050
Fax (702) 687-3957

Las Vegas Branch
4220 S. Maryland Pkwy.
Suite 304
Las Vegas, Nevada 89119
(702) 486-7250
Fax (702) 486-7252

RUSSELL A. FIELDS
Executive Director

December 27, 1993

RECEIVED
DEC 28 1993
DEPT. OF ADMINISTRATION
DIRECTOR'S OFFICE

Mr. John Walker
Nevada State Clearinghouse
Dept. of Administration, Planning Division
Blasdel Bldg., Rm. 200
Carson City, NV 89710

Re: SAI #94300044, Jerritt Canyon Expansion DEIS

Dear Mr. Walker,

The Nevada Division of Minerals has reviewed the above referenced DEIS and supports the Preferred Alternative C for expansion activities at the Jerritt Canyon mining operation.

The Division participated in the development of the DEIS as a member of the interdisciplinary team that worked on the focus issues and the alternatives to the Proposed Alternative B. That process, together with public scoping and an excellent job of coalescing many options, has led to an outstanding environmental document.

The Jerritt Canyon expansion is of major importance to the economy and citizens of Elko County. The expansion under the Preferred Alternative C will allow mining and processing operations to continue until at least the year 2005, as opposed to closure of the operation in 1994, under the No Action Alternative. Alternative C is the best alternative for balancing protection of the abundant wildlife, water, scenic and other resources in the Independence Mountains with the economic mining and processing of gold ore. Because the rather fine distinctions between Alternative C and other Alternatives would result in significant differences in the economics of mining and protection of the environment, any operational changes to Alternative C must be carefully evaluated and justified before implementation.

We appreciate the opportunity to provide these comments and commend the U.S.F.S Humboldt National Forest, Independence Mining Company and all those who contributed to the DEIS for their excellent efforts on this important project.

Sincerely,

Russ Fields

Russ Fields,
Administrator

L. H. DODGION
Administrator

STATE OF NEVADA
BOB MILLER
Governor

PETER G. MORROS
Director

Administration (702) 687-4670
Air Quality 687-5065
Mining Regulation and Reclamation 687-4675
Water Quality Planning 687-5883
Water Pollution Control 687-5870
Fax 687-5856

Waste Management 687-5872
Chemical Hazards Management 687-5872
Federal Facilities 687-5872
885-0868

DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES
DIVISION OF ENVIRONMENTAL PROTECTION
Capitol Complex
333 W. Nye Lane
Carson City, Nevada 89710

Mtn. City Ranger District
FEB 03 '94
DFR
MINERALS
WL BIO
FORESTER
RANGE TECH.
FOR TECH.
S.S.S.
TYPIST

RECEIVED
JAN 20 1994
DEPT. OF ADMINISTRATION
DIRECTOR'S OFFICE

January 19, 1994

CLEARINGHOUSE COMMENTS

NDEP # 94-046
SAI NV # 94300044

TITLE: USFS - Draft EIS for Jerritt Canyon Mine Expansion in Elko

The Division of Environmental Protection has reviewed the aforementioned State Clearinghouse item and has the following comments:

The Bureau of Air Quality states that prior to any surface are disturbance associated with the mine expansion, IMC must apply for and receive an air quality permit to construct.

The Bureau of Water Pollution Control states that discharge permits will be required for any discharges to the surface or groundwater of the state. In addition, the pollution prevention plan for the stormwater permit will have to be revised to include the new construction.

The Bureau of Mining Regulation and Reclamation states that the proposed operation and its subsequent reclamation must meet the requirements of NAC and NRS 519A and 445. In addition, the angle of repose slopes must be shown to be stable under long term geologic conditions (seismic return intervals 100 years or more). The angle of repose slopes must also be shown to meet the requirements of the productive post-mining land use described int he application (usually the same as the pre-mining use). NRS and NAC 519A have no provisions to exempt any areas from this land use, with the exception of certain qualifying pits and rock faces. Since the waste rock slopes may not be exempt from reclamation, a vegetative cover appropriate for the post-mining land use must be provided for (per NRS 519A.230.b, 519A.330.1.a, 519A.345.b)

NDEP # 94-046 - SAI NV # 94300044
USFS - Draft EIS for Jerritt Canyon Mine Expansion in Elko
January 19, 1994

The waste dumps must also show surface stability (erosional) comparable to that of adjacent undisturbed areas by quantitative analysis. All roads will be required to approximate the original contour (per NAC 519A.345). Independence Mining Company should consider locating waste rock in the lesser-sloped pediment areas where obstruction of drainage may be avoided and regrading costs may be reduced. An attempt should be made to blend the waste dumps into the surrounding topography to minimize adverse visual effects. Efforts should be made to re-establish slopes similar to those of the area before mining (if constructed to be stable). Gentle slopes are generally a preferable habitat for wildlife than large flat or extremely steep areas.

The Jerritt Canyon Project is currently being reviewed for renewal of Water Pollution Control Permit number NEV00020. During this review, pit water quality, waste rock sampling and location, drainage location, process component integrity, and monitoring adequacy will be evaluated prior to renewal approval. A Nevada Water Pollution Control Permit (zero discharge) will require waste rock management plans that influence the location of waste rock in drainage areas. Pit water quality studies will be required to evaluate the conditions of post mining pit water lakes left at Jerritt Canyon (NAC 445.24352.3)

David R. Cowperthwaite
Clearinghouse Coordinator
Nevada Division of Environmental Protection

Letter #22

January 8,1994

Mr. Jack Carlson, District Ranger
Mountain City Ranger District
P.O. Box 276
Mountain City, Nv 89831

Dear Mr. Carlson,

I am writing to tell you that I am strongly opposed to the Jerritt Canyon mine expansion by the Independence Mining Company.

1 I agree with Jim Connelly that ranchers and miners ought to be able to work together whenever possible. However, when livestock owners are utilizing a grazing permit, and are established long before mining operations move in, I believe their rights, especially their water rights should be protected as guaranteed by the U.S. Constitution.

2 I encourage you to take a look at the long-term picture. Our small Independence Valley Community needs an encouraging, hopeful future for livestock ranchers (who depend on grazing on the public lands) to stay. Ranchers are stable, honest people who contribute to the county tax base as well as to improving the environment around them. The more water developements a rancher puts in for his cattle, the more it attracts wildlife. Cattle and wildlife are COMPLIMENTARY to each other; mining and wildlife aren't. Cattle contribute to vegetation and grasses staying vibrant and suculant - a most attractive benefit to wildlife.

I am in favor of mining operations in communities when they don't push long established livestock producers out of existence, let alone permantely destroying habitat for native wildlife. It seems to me that there has got to be another solution to this problem other than giving livestock grazing permittees a 50% cut. A mining company such as IMC obviously has the technology and financial resources to locate other possible sites where they would be welcomed.

Thank You for the opportunity to express my opinion.

Most sincerely yours,

Renee R. Jackson

Renee R. Jackson

Letter #22
Renee Jackson

Response 1

Approval of any POO by the USFS does not authorize a mining company to infringe upon the water rights of other parties. Water rights and their administration are the authority of the Nevada State Engineer's Office.

Response 2

The FEIS has examined long term effects to this proposed project by displaying cumulative effects. Cumulative effects include past, present, and reasonably foreseeable future actions. Section 2.4 of the DEIS describes IMC's proposed project based on current conditions, and also discusses a reasonably foreseeable future if the price of gold were to increase. This FEIS uses the reasonably foreseeable future (largest disturbance) as the basis of its analysis.

Letter #23

BOB MILLER
Governor

STATE OF NEVADA

PETER G. MORROS
Director

R. MICHAEL TURNIPSEED, P.E.
State Engineer

DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES
DIVISION OF WATER RESOURCES
Capitol Complex
123 W. Nye Lane
Carson City, Nevada 89710
(702) 687-4380

January 21, 1994

Don Carpenter
USDA Forest Service
Humboldt National Forest
Mountain City Ranger District
P.O. Box 276
Mountain City, Nevada 89831

Re: (No. 1950) Jerritt Canyon Mine Expansion
Draft Environmental Impact Statement (DEIS)

Dear Mr. Carpenter:

Thank you for this opportunity to submit informal comments for your consideration on the above-referenced DEIS, in light of the fact the January 18, 1994 deadline has passed.

This office is responsible for administering Nevada water law and is primarily concerned with the project's existing and proposed diversions of surface waters and/or the interference with spring discharges. This office is responsible for protecting existing prior rights, if any, of downstream water users.

Pages 4-22 through 4-24 of the DEIS document existing and proposed reduction of surface water runoff by the project pits. These diversions must be permitted under state law. Certainly it can be argued that every acre-foot of water diverted by mining activity, that would have reached the Humboldt River decreed system under normal pre-mining runoff conditions, must be accounted for through permits to change existing rights to divert that water.

Interference with spring discharge by pit dewatering or other mine related pumping shall also be permitted by this office. The mine operator will be required to show in detail that reduced spring discharges, if any, are <u>not</u> a result of mining activity. Destruction of spring areas by other mine activities (waste rock dumps) in effect also interferes with discharge and is also a concern.

Letter #23
Nevada Department of Conservation and Natural Resources

Letter received after comment period ended. Comments were reviewed and considered.

Don Carpenter
January 21, 1994
Page 2

Waste rock dumps in stream channels will also require State Engineer permits, and design and function of under-dump drainage systems is a concern.

The limited discussion in the DEIS with respect to mitigation of water resource impacts is vague and ambiguous, and does not appear to bind the operator to any commitments such as a memorandum of understanding.

The operator has in place some permits for groundwater pumpage for mine process water and for existing dams. If you have any questions, please communicate at your earliest convenience.

Sincerely,

Thomas K. Gallagher, P.E.
Hydraulic Engineer III

TKG/bk

BOB MILLER
Governor

STATE OF NEVADA

PETER G. MORROS
Director

R. MICHAEL TURNIPSEED, P.E.
State Engineer

DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES
DIVISION OF WATER RESOURCES
Capitol Complex
123 W. Nye Lane
Carson City, Nevada 89710
(702) 687-4380

March 15, 1994

Don Carpenter
USDA Forest Service
Humboldt National Forest
Mountain City Ranger District
P.O. Box 276
Mountain City, NV 89831

Dear Mr. Carpenter:

Subject: (No. 1950) Jerritt Canyon Mine Expansion
Draft Environmental Impact Statement (DEIS)

This letter is intended to clarify and amend certain points in a letter dated January 21, 1994, signed by Thomas K. Gallagher, P.E., of the Division of Water Resources.

The drainage basin in which this project is located is in the Independence Valley Groundwater Basin. All of the surface water within the project area drains into the South Fork Owyhee River and <u>not to the Humboldt River</u>.

Certain areas within the project boundaries have permits for mining and milling purposes, and also for exploration purposes. Pending applications are also on file to cover other areas within the project boundaries. An application to change the current water rights must be filed for any water use other than for the company's present authorized uses. The change applications must identify the amount of water, the source of water, and specific points of diversion, place of use, and manner of use.

The procedure for such change application is set forth in Chapters 533 and 534 of the Nevada Revised Statutes. The State Engineer cannot predetermine what action will be taken on such change applications until such applications have been processed through the publication and protest period.

Don Carpenter
March 15, 1994
Page two

Any permits, if issued, would be subject to existing water rights, whether permitted or decreed. If any prior right is affected by the mining activity, the State Engineer would be required by law to protect those prior water rights. Mitigation measures may be by agreement between parties provided the appropriate water rights are in place as stated above.

The drainage and sediment control structures as described in the various alternatives would become jurisdictional under Chapter 535 of the Nevada Revised Statutes. A structure which is over 20 feet in height or stores more than 20 acre-feet will require a permit along with approval of plans and specifications before the construction of such a structure.

This letter is intended to supersede the letter of January 21, 1994 and if you should have any questions, please feel free to contact me.

Very truly yours,

Hugh Ricci, P.E.
Deputy State Engineer

HR/bl

Letter #24

JAN 27 '94

ACTION
DFR
SUPRV RNGE
MINERALS
E.A. COORD
WL BIO.
FORESTER
RANGE TECH
FOR TECH.
XSS.
TYPIST

1/24

Dear Mr. Carpenter:

I would like to express my extreme concern about the corrosive nature of the Independence Mining Company. Claiming its "statutory right" to destroy more land based on a law 100 years out of date is poor public policy.

The 1872 Mining Law is based on a reality long since extinct. No longer are our mines rich w/veins, our animals countless and menacing, our timber supply endless. Our supplies are finite, and your policy should the best of our society, not reflective of unthinking greed and neglect for future generations. The fact that ~~of~~ 8 new open pits have been dug in the past 12 years in the Independence Mountains blows away any tourist incentive

Letter #24
Mark Endrizzi

Letter received after comment period ended. Comments were reviewed and considered.

to go there. I also speak for a huge number of Oregonians who are upset at the thought of Grassy Mt. being obliterated by Nevada-style (indeed, a Nevada Company!) cyanide leach-mining. Few substances are more toxic to any form of organic ~~was~~ matter. 3,000 acres of national forest land should not be sacrificed to short-term profit (and long-term destruction).

Nevada is not a wasteland, as many Americans believe. Please bring mining laws into the 21st Century. Thank you for your time.

Sincerely,

Mark Endrizzi

Mark Endrizzi
1290 W. 5th
Eugene, OR 97402

Letter #25

January 23, 1994

Ms. Lesley T. Cusick
483 Mahoney Road
Oliver Springs, Tennessee 37840

Mr. Jack M. Carlson
District Ranger
Humboldt National Forest
Mountain City Ranger District
P.O. Box 276
Mountain City, Nevada 89831

Dear Mr. Carlson,

The following are my comments on the Jerritt Canyon Mine Expansion Draft Environmental Impact Statement. All in all, I found the DEIS to be very informative, clear, fairly concise, and complete. In those areas where information was incomplete or unavailable at the time of publication, the text was explanatory about the deficiencies.

As I am not a resident of the Project Area, or even the State of Nevada, I do not have a "stake" in the outcome of the project; I do however, have an interest in the project. The idea of a private, extractive, enterprise operating on public land (with minimal public return), is a difficult one for me to accept, but I do understand that it is legal, and, encouraged. It is for that reason that I wanted to become part of the "process", by reading the documents, performing additional research, and, ultimately - providing comments, as warranted. Thank you for the opportunity to review the DEIS, and for your consideration of my comments.

Chapter 2 - Alternatives Including the Proposed Action

pg. 2-49 - Livestock Grazing: Will the grazing areas lost to project development be completely restored and reclaimed? Have the impacts of creating new water sources in relocated allotments been assessed. If yes, where in the document is the information found?

Chapter 3 - Affected Environment

pg. 3-7, ¶ 5 (Acid-Base Accounting): This paragraph discusses the lack of information presently available on the NP/AP analysis for the intrusives that may be found in the New Deep mine area. It indicates that results will be discussed in the FEIS. However, in Chapter 4 (p. 4-6, ¶ 3), the text indicates that geochemical analyses are not conclusive...results of the static kinetic testing would be used to develop a waste rock evaluation program... (but that), "The actual waste rock testing and monitoring program that would be implemented during active mining would be described in the final POO."

Letter #25
Lesley Cusick

Letter received after comment period ended. Comments were reviewed and considered.

The latter statement seems to contradict the plan of including the sampling data in the FEIS. Please clarify the stage where the NP/AP data will be available, and explain why it would be acceptable to proceed with any of the proposals, when analysis with (potentially) unfavorable findings may result?

pg. 3-38 (Candidate and Sensitive Species): Will any protective measures be implemented for those areas that constitute suitable habitat for the USFWS Category sensitive species Lewis's buckwheat? If yes, please describe. If no, why not?

pg. 3-55, Mule Deer Habitat: Considering the fact that certain activities, both man-induced and otherwise, have affected the mule deer habitat, does the USFS and the USFWS find it acceptable that the proposed action will disrupt 11% of the high and moderate value winter range?

Chapter 4 - Environmental Consequences

pg. 4-6, ¶ 2, Effects Common to All Action Alternatives: In regard to the potential for production of acid producing runoff. The text states "Because the intrusives generally occur as narrow bands ranging from two to ten feet in thickness...dilution and mixing with limestone and siltstone may be promoted." What factors would lead to the use of this method as opposed to factors that would discourage its implementation?

pg. 4-7, ¶ 4, Cumulative Effects: The text explains that baseline data were not collected to evaluate sulfate concentrations, but that downgradient springs exhibit sulfate concentrations higher than drinking water standards. If continued increases in sulfates are found in the downgradient springs over the present levels, what measures can be taken to ascertain if the mining operation is the cause of the increased levels. What measures would be undertaken to mitigate (further) increased sulfate levels, should they occur?

pg. 4-24, ¶ 1 (Surface Water Quantity - Jerritt Creek): Who are the downstream users referred to in the text?

pg. 4-50, ¶ 2, Sensitive Species: Despite the fact that flammulated owls were not detected during the field surveys, what steps will be taken if sensitive species are encountered during project development? Would there be plans to delay work in certain areas to allow for nesting, for example?

pg. 4-68, ¶ 5, Land Use Planning and Management: The text indicates that some of the proposed alternatives (A, D, and E) would be in conflict with Elko County's draft [land use] policy. That may be the case, however, "absolute" policies may be drafted for a number of purposes - some to encourage certain types of development or zoning, some to discourage. Just because something is legal, doesn't mean it's right, and in this case, a conflict with the policy should not unduly exclude these alternatives from consideration.

After reading the EIS and considering the information and alternatives put forward, I believe that Alternative E would be the best compromise for development and environmental protection. This alternative, while costing more than that proposed by IMC (Alternative B), and the Forest Service (Alternative C), has a lesser effect on sensitive resources. Fewer haul road distances, angle of repose slopes, and lessened effects to wetlands, sensitive species habitats, and watersheds are all

favorable. This alternative, unlike D, will allow for access to identified resources. It also avoids adverse impacts of other alternatives which include work below the groundwater table, potential subsidence, higher costs, and larger areas of disturbance.

Thank you again for the opportunity to read the EIS and to provide comments. I look forward to reading the revised document and any future materials provided.

Sincerely,

Lesley T. Cusick

Letter #26

STATE OF NEVADA
BOB MILLER
Governor

L. H. DODGION
Administrator

PETER G. MORROS
Director

Administration	(702) 687-4670
Air Quality	687-5065
Mining Regulation and Reclamation	687-4675
Water Quality Planning	687-5883
Water Pollution Control	687-5870
Fax	687-5856

Waste Management	687-5872
Chemical Hazards Management	687-5872
Federal Facilities	687-5872
Fax	885-0868

DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES
DIVISION OF ENVIRONMENTAL PROTECTION
Capitol Complex
333 W. Nye Lane
Carson City, Nevada 89710

February 4, 1994

Mr. Don L. Carpenter, Minerals Management Specialist
U.S.F.S., Humboldt National Forest, Region 4
Mountain City Ranger District
Post Office Box 276
Mountain City, Nevada 89831

Dear Mr. Carpenter:

Please find attached revised Bureau of Water Quality Planning's comments to Independence Mining Company's proposed Jerritt Canyon Mine Expansion Draft Environmental Impact Statement. Revisions are based upon review and comments from Mr. Doug Zimmerman, Bureau of Mining Regulation and Reclamation, Ms. Kathy Sertic and Mr. Pete Anderson, Bureau of Water Quality Planning.

Should you have any questions, please feel free to contact me at (702) 687-4670, extension 3098.

Sincerely,

Wendell D. McCurry

Wendell D. McCurry
Chief
Bureau of Water Quality Planning

WDM:PHA/cfw
cc: Pete Anderson
Kathy Sertic
Doug Zimmerman

Letter #26
NDEP

Letter received after comment period ended. Comments were reviewed and considered.

COMMENTS TO
JERRITT CANYON MINE EXPANSION
"DRAFT" ENVIRONMENTAL IMPACT STATEMENT

FROM
BUREAU OF WATER QUALITY PLANNING
NEVADA DIVISION OF ENVIRONMENTAL PROTECTION

February 3, 1994

HYDROLOGY

The descriptions of the surface and ground water hydrological systems of the Jerritt Canyon Mine Expansion project area and the associated impacts to the environment from the proposed action alternatives have not been adequately evaluated. Specific issues include:

* Reduction in surface runoff and associated impacts to down stream riparian ecosystems and wetlands, existing beneficial uses, surface and ground water quality, and ground water recharge (Pg. 2-43, Par. 3; Pg. 4-36, Par. 1).

* Stream channel modifications (Pg. 4-25 to 4-27, Par. 5).

* The effects of dewatering on surface and ground water resources (Pg. 2-13, Par. 3).

* Pit lake chemistry (Pg. 4-35, Par. 3).

* The potential for acid generation, the mobilization of other contaminants and a lack of statistically adequate data (Pg. 2-15, Par. 4; Pg. 2-51, Par. 4; Pg. 4-6, Par. 3&4).

* Cumulative effects of the action alternatives on the South Fork of the Owyhee River and the Snake River (Pg. 4-7, Par. 3).

NONPOINT SOURCE POLLUTION

Sediment Control

Given the project site topography, precipitation, surface runoff, and the past performance of sediment and erosion control management within existing Jerritt Canyon operations, the proposed nonpoint source pollution control measures and the evaluation of associated impacts to the environment are inadequate. Best Management Practices (BMPs) are not discussed or evaluated within the EIS (Pg. 2-17; Pg. 2-19, Par. 5-7; Pg. 2-21, Par. 1; Pg. 4-27, Par. 1).

Comments to Jerritt Canyon Mine Expansion, Draft EIS
Page Two

Dumps

Dump stability, location, design, foundation and the potential for dump failure, negatively impacting surface and ground water resources, wetlands, stream channels and riparian habitat have not been fully evaluated (Pg. 2-15, Par. 3&4; Pg. 2-31, Par. 6; Pg. 4-10, Par. 1-3; Pg. 4-11, Par. 3).

Haul & Access Roads

The potential for haul and access road cut and fill slopes to act as sources of nonpoint pollution and their associated impacts to the environment have not been adequately discussed (Pg. 2-17).

Pits

The proposed disturbances do not meet the requirements of NAC 445.24352 which states:

> "2. Open pit mines must, to the extent practicable, be free-draining or left in a manner which minimizes the impoundment of surface drainage and the potential for contaminants to be transported and degrade the waters of the state."
>
> "3. Bodies of water which are a result of mine pits penetrating the water table must not create an impoundment which:
>
> (a) Has the potential to degrade the ground waters of the state; or
>
> (b) Has the potential to affect adversely the health of human, terrestrial or avian life."

(Pg. 4-23, Par. 4)

Revegetation

Current scientific research and technology in the field of disturbed site revegetation indicates extreme difficulties in establishing permanent viable vegetation on angle of repose slopes, therefore the associated impacts to wildlife and surface and ground water resources has not been adequately addressed (Pg. 4-27, Par. 5).

MITIGATION

Proposed mitigation measures are unclear and lack specificity regarding mitigation of identified impacts to surface and ground water resources (Pg 2-42, Par. 5&6; Pg. 2-44, Par. 2-6).

The wetlands mitigation and monitoring plan should be included within the Draft EIS (Pg. 2-45, Par. 2-6).

Letter #27

United States Department of the Interior

OFFICE OF THE SECRETARY
Office of Environmental Policy and Compliance
600 Harrison Street, Suite 515
San Francisco, CA 94107-1376

February 3, 1994

ER 93/991

John Inman, Forest Supervisor
Humboldt National Forest
976 Mountain City Highway
Elko, Nevada 89931

Dear Mr. Inman:

The Department of the Interior (Department) has reviewed the Draft Environmental Impact Statement (DEIS) for Jerritt Canyon Mine Expansion, Humboldt National Forest, Elko County, Nevada. The following comments are provided for your use and information when preparing the final documents.

GENERAL COMMENTS

Variations Among Alternatives

Generally speaking, the differences among the proposals are slight, with the exception of those calling for shaft mining. The primary differences are relatively small variances in the size of the dumps. There are no alternatives that call for a significantly reduced mine area, nor are there any that emphasize any resource other than mineral development.

Aspen Habitat Fragmentation

Aspen habitat fragmentation has been caused by natural occurrences and previous mining activities. Further fragmentation on the order of 655 acres is anticipated to occur after mine expansion.

Given that aspen habitat provides a vital link for wildlife and that this habitat is already fragmented, how will mine expansion impact wildlife, and is this likely to cause undue pressure upon T&E species?

Mule Deer Habitat

All of the alternatives exceed the threshold of concern (TOC) for winter and summer range as well as fawning habitat. In some cases, the habitat lost will reach nearly fifty percent. The impacted subpopulation will not receive any benefit from these

Letter #27
U.S. Department of the Interior

Letter received after comment period ended. Comments were reviewed and considered.

rehabilitation projects. The mitigation plan offered seems to fall short and should be revised in the final document.

The Memorandum of Understanding (MOU) presented as an appendix is vague and lacks the detailed analysis and cumulative impacts studies given to other plans. This plan is critical since it is the only mitigation offered for mule deer habitat loss.

For this plan to succeed, monitoring is crucial. The adaptive management policy alluded to needs to be fully developed. Such issues as who will make decisions and implement changes when the need arises is not addressed. There are no specific guidelines to assist the agency or group charged with implementing this plan. Are there plans to budget for continued mitigation and monitoring? More detail is needed in the final documents.

It is particularly important that the results of planned actions, mitigations, and monitoring actually be used. Knowing what works and what doesn't must lead to adaptive management, i.e., using this information and knowledge to appropriately continue or change what you are doing to manage the resources.

The final documents should discuss in some detail the mechanisms you have devised to identify and commit budgetary and organizational resources to both the monitoring and adaptive management of the Forest. We would be happy to assist you in this process if you so desire.

The MOU will substitute acreages of low productivity for areas of high productivity. Three times the acreage of disturbed land will be developed. The success of this project seems dubious and one wonders why highly productive land is to be sacrificed. Onsite projects, using more productive lands, should be developed prior to looking offsite.

The Forest Service should tie mine expansion to the success of mitigation and allow further mineral development in proportion to mitigation success.

Goshawk Habitat

Impacts to goshawk nests 047, 127, and 128 dramatically exceed the TOC for this species. Impacts to nest 134 and 136 are almost at the short-term TOC and exceed the long-term TOC. What is the significance of this loss to this species? What mitigation measures will be taken to reduce hardships caused by this project? A mitigation plan should developed to compensate for lost goshawk habitat.

The Fish and Wildlife Service (FWS) is not familiar with the Meteoric Water Mobility Procedure developed by the Nevada Division of Environmental Protection. The final documents should indicate the applicability, constraints, and general acceptance of this procedure by the scientific community and other regulatory agencies may be warranted.

The DEIS does not specify the number of samples tested or present the results of these tests. We recommend that test results and any subsequent tests (i.e., EPA procedure 1312) be presented in the final documents.

A concentration of 10 times the State of Nevada drinking water standards was used to assign environmental risk from trace elements mobilization. The State of Nevada and the EPA water quality standards for the protection of aquatic life are more stringent for certain trace elements, and drinking water standards do not exist for other trace elements of concern for fish and wildlife. Standards for the protection of aquatic life and the propagation of fish and wildlife may be more appropriate to assess environmental risk.

<u>Page 3-15. Air Quality</u> A discussion on the potential impacts of blasting, blasting agents, and products of blasting agents to air quality is needed. If products of blasting agents are determined to be a concern to fish and wildlife resources, these constituents should be monitored.

<u>Page 3-21. Surface Water Quality</u> Independence Mining Company has been monitoring water quality monthly at several locations in and near the project area since 1981. However, data from this monitoring program are not presented in a manner which allows ready evaluation of trends or determination of long-term changes in water quality parameters. We recommend using a format for which monthly and annual changes may be analyzed at discrete points.

The limited data available in Tables A1 and A2 indicate that sulfate and total dissolved solid levels have increased over pre-mining levels in areas below under-dump flow. Increased levels of these parameters may be an indicator of acid generation. As mentioned above, these data should be presented in a manner which enables the evaluation of trends. Detailed discussion of these results in relation to under-dump flow is needed.

The DEIS is not clear regarding the sampling of metals from 1981 to 1992. The results of monitoring for metals during this period should be presented. If metals were not monitored during this period, then the recent data from 1992 and 1993 should be presented. This information is critical in assessing potential impacts to fish and wildlife resources from metal contaminants.

Changes from pre-project levels and implications to fish and wildlife should be discussed in detail.

The potential impacts of blasting, blasting agents, and products of blasting agents to surface water quality needs to be discussed. If any constituents of blasting agents are identified as a concern to fish and wildlife resources, they should be monitored.

Page 3-24. Springs and Seeps Many isolated springs and seeps in Nevada contain unique and endemic snail fauna. The spring and seep survey, conducted in the project area during summer 1993, identifies 23 springs and 8 seeps in the project area. The status of snail surveys needs to be identified in the final documents. If such surveys were conducted, the results need to be given. If not, we recommend that the springs and seeps be surveyed for endemic snails.

Page 3-28. Ground Water Resources: Ground Water Quality Water quality of springs GDSP-10 and MCDS-10 is identified as generally poor. Some parameters exceed Nevada water quality standards. These springs are adjacent to and down gradient from existing waste rock dumps. A detailed discussion of potential impacts of waste rock dumps to ground water and spring discharge quality is needed.

Pages 3-37 to 3-39. Threatened, Endangered, Candidate, and Sensitive Plants In addition to the given category 2 candidate plant species, at least two other category 2 candidate species occur in the Independence Mountains. Descriptions of these species are as follows:

- o Leiberg clover (*Trifolium leibergii*) is a rare taxon. It occurs on shady talus slopes at elevations of 6,500 to 8,000 feet in the Independence Mountains (Jacks Creek area), Jarbridge Mountains, and in southern Oregon. Leiberg clover is on the Northern Nevada Native Plant Society (NNNPS) watch list.

- o Least phacelia (*Phacelia minutissima*) is another rare taxon. It occurs in gravelly soils on northern aspects, slopes vegetated with mountain brush to sunny flats at elevations of 6,000 to 7,800 feet. As presently known, its distribution in Nevada includes Gold Creek, east of Wildhorse Reservoir, and Stump Creek in the Independence Mountains. It is also known from disjunct populations in Oregon and Utah. Candidate status for least phacelia was published for the first time in the September 30, 1993, Notice of Review of plant taxa (58 FR 51144). Least phacelia is included on the NNNPS list of threatened species.

o In addition, the Grimes vetchling also is included on the NNNPS list of threatened species.

We recommend that surveys be conducted for these species in the project area prior to project implementation and that measures be taken to protect any new populations. The survey results and protective measures taken should be addressed in the final documents.

We also recommend that this section include a table listing candidate and sensitive plant species potentially occurring in the project area.

Page 3-49. Threatened Species In the existing mining operations, ore is transported to the IMC's mill on the eastern side of the Independence Range. Transportation routes occur along Winters and California Creeks. Both support the threatened Lahontan Cutthroat Trout.

To identify possible adverse impacts to the LCT, the IMC has monitored water quality, riparian habitat quality, and macroinvertebrates. Because potential impacts to the LCT from the haul roads would continue under the proposed project, results of IMC's monitoring activities in these creeks should be presented. Any changes in components monitored or potential impacts to the LCT should be discussed in detail.

Page 4-22. Surface Water Quantity The continued drainage efficiencies and expected life of the under-dump drainage system need to be discussed. The environmental consequences of under-dump drain failure should be identified.

Page 4-27. Surface Water Quality The DEIS explains that in the event monitoring reveals a problem with acid generation or leaching of trace elements in dumps, appropriate remedial action would be taken. The types of remedial alternatives that are proposed and past success of various alternatives in correcting the problem need to be discussed.

Although this section discusses the potential for contaminants or acid leachate to be released from waste rock, ore stockpiles or pits, and introduced into surface waters, it does not specifically address the question of pit water quality after the project is completed.

The final elevation of the New Deep Pit bottom would be 5,960 feet, approximately 140 feet below the estimated regional ground water surface elevation. As pit water quality has been a concern at other open pit mining operations, it should be addressed for this proposal.

A thorough discussion on expected pit water quality and potential long-term degradation from evaporation is needed. A detailed discussion on potential impacts to wildlife, particularly migratory birds, should also be provided. This discussion should include potential implications for future reproductive success of migratory birds using the pit lake during migration to nesting areas.

Several open pit mine lakes throughout the west, including most in Nevada, contain water of extremely poor quality. Many of these lakes pose significant threats to fish and wildlife. In some cases, such as the Berkeley Pit in Montana, conditions have warranted action under the Comprehensive Environmental Response, Compensation, and Liability Act.

Remediation and mitigation for these environmental problems would not only be extremely difficult but also would be extremely expensive.

The DEIS does not demonstrate that pit water quality would not degrade to a point where it wold pose a potential threat to wildlife. If the potential for significant water quality degradation is realized, another alternative including backfilling of the New Deep Pit, at least to a level above the water table, should be evaluated.

Page 4-35. Ground water Quality The DEIS indicates that if water impounded in the New Deep Pit does not meet Nevada water quality standards, it would be treated to meet these standards. We recommend specifying the duration of such treatments following cessation of mining activities.

Poor water quality of springs adjacent to existing waste rock dumps indicates that similar degradation of water quality is possible if not likely. No monitoring of springs potentially impacted by the proposed project area is offered. Similarly, no remedial actions are offered in the event that discharge quality is affected.

Discharge quality of springs potentially impacted by the project should be monitored. Monitoring should occur prior to disturbance of the proposed project. The length of time that monitoring will follow cessation of mining activities and the length of time that IMC will be required to remediate affected springs needs to be specified. Again, an adaptive management approach to using the data gained from the monitoring needs to be detailed in the FEIS.

Page 4-41. Threatened, Endangered, Candidate, and Sensitive Plants Survey results for Leiberg clover and least phacelia should be included.

Page 4-46. Reclamation Potential, last paragraph It is stated that some species in the seed mixture are not native to the area. We recommend against the planting of introduced species unless they would serve as nurse plants and die out within a few years. Native species indigenous to the area should be used for reclamation with an overall goal of restoration of the natural ecosystem.

Mitigation. In addition to the mitigation proposed in the Statement, we recommend the following measure be adopted:

- To mitigate for the long-term impact of the evaporation from the final New Deep Pit Lake, we recommend the applicant purchase an equivalent amount of existing senior water rights in the area and transfer them to a resource management agency for "wildlife purposes" as defined in NRS 533.023.

SUMMARY COMMENTS

We recommend that additional information be provided in the Statement on the potential for impacts to the threatened LCT and the candidate redband trout, candidate plants, and on water quality impacts to wildlife. An expanded discussion of cumulative impacts to fish and wildlife resources is needed.

If you have any questions on these comments, please contact the Office of Environmental Policy and Compliance at 415/744-4090.

Sincerely,

Patricia S Port

Patricia Sanderson Port
Regional Environmental Officer

cc: Director, OEPC, w/original incoming
Regional Director, FWS, Portland
State Director, BLM, NV

Supplemental Information

Photo Description: Looking south down Jerritt Canyon tributary (Spring 1993).

REFERENCES

*Abt Associates Inc., 1979. *Revised Preliminary Draft Socioeconomic Component Draft Environmental Statement*, Technical Report for Jerritt Canyon Project. Englewood, CO.

Albrechtsen, B., and E.E. Farmer, 1987. *R4 Reclamation Field Guide*. USDS Forest Service Region IV Minerals Management, Odgen, Utah. 81 pp.

Anastassatos, George, Economist, Nevada Employment Security Department. Personal communication, October 13, 1992.

Anastassatos, George, Economist, Nevada Employment Security Department. Personal communication, March 1, 1993.

Anderson, Steve, Wildlife Biologist, Humboldt National Forest. Personal communication, September, 1993.

Ankrum, Sharon, Assistant City Clerk, City of Carlin. Personal communication, April 6, 1993.

Aquirre, Joe, Elko County Assessor. Personal communication, October 14, 1992.

Back, Gary, USDI - BLM. Personal communication.

Bacus, Larry, Highway Maintenance Supervisor II, Elko District, Nevada Department of Highways. Personal communication. August 26, 1992.

Birak, D. J., and Hawkins, R. B., 1984. *The Geology of the Enfield Bell Mine and the Jerritt Canyon District, Elko County, Nevada*, in Sediment-hosted Precious Metal Deposits of Northern Nevada, J. V. Tingley and H. F. Bonham, eds., Nevada Bureau of Mines and Geology Report 40.

Blackburn, Paul, Soil Scientist, 1992. U.S. Department of Agriculture, Soil Conservation Service, Elko, NV. Personal Communications.

Born, J.D., R.P. Tymcio, and O.E. Casey, 1992. Nevada Forest Resources, USDA Forest Service Intermountain Research Station Resource Bulletin INT-76, 64 p.

Bosma-Douglas, IMC Geologist. FAX transmittal, August 27, 1993.

Boucher, George, County Manager, Elko County. Personal communication, October 27, 1992.

This document is incorporated by reference into the FEIS

Broughton, L.M., R.W. Chambers and A MacG. Robertson, 1992. Mine Rock Guidelines: Design and Control of Drainages Water Quality; Report 933-1, Saskatchewan Environment and Public Safety, Mines Pollution Control Branch, Prince Albert, Sask.

Carlson, Jack M., District Ranger - Mountain City District, Humboldt National Forest, Written Correspondence, February 16, 1993 and March 26, 1993.

Chapman, Llee, Chairman, Board of Elko County Commissioners. Personal communication, May 26, 1993.

Chapman, Llee, Chairman, Board of Elko County Commissioners. Personal communication, June 3, 1993.

Chapman, Llee, Chairman, Board of Elko County Commissioners. Personal communication, July 27, 1993.

City of Elko, Building Department. Building permit statistics, 1980-1992.

Clarke, Doug. USFS, Mountain City Ranger District, Mountain City, Nevada. Telephone interview. June 11, 1993.

Clark, Mike, Nevada Employment Security Department. Personal communication, April 7, 1993.

Coats, R.R., 1987. *Geology of Elko County, Nevada.* Nevada Bureau of Mines and Geology Bulletin 101.

Coburn, Mary, Westec. Field Observations 1992.

Colbeck, C. 1988. *Snowmelt Increases Through Albedo Reduction, U.S. Army Corps of Engineers, Cold Region Research and Engineering Laboratory*. Special Report 88-26.

Condor Earth Technologies, 1993. Surface Water Modeling and Calculations for Jerritt Canyon Expansion. Sonora, CA.

Crampton, Norman, 1993. *The 100 Best Small Towns in America.* Prentice Hall, New York.

Cumming, Chantal, IMC, Public and Government Affairs Director. Personal communication, November 18, 1992.

Davis, Dave, BLM, Battle Mountain District. Personal communication, May 11, 1993.

Desert Research Institute, 1991a. *Particulate and Meteorology Monitoring at Independence Mine Quarterly Report Jan/March.* Reno, NV.

Desert Research Institute, 1991b. *Particulate and Meteorology Monitoring at Independence Mine Quarterly Report April/June, 1990.* Reno, NV.

Desert Research Institute, 1991c. *Particulate and Meteorology Monitoring at Independence Mine Quarterly Report Oct/Dec. 1990.* Reno, NV.

Desert Research Institute, 1991d. *Particulate and Meteorology Monitoring at Independence Mine Quarterly Report June/Sept. 1990.* Reno, NV.

Desert Research Institute, 1991e. *Particulate and Meteorology Monitoring at Independence Mine Supplemental Report.* Reno, NV.

Dobra, John L., Ph.D., 1989. *The Economic Impacts of Nevada's Mineral Industry, 1988 Update.* Nevada Bureau of Mines and Geology Special Publication L-9.

Eakin, T.E., 1962. *Groundwater Appraisal of Independence Valley, Western Elko County, Nevada.* Nevada Department of Conservation and Natural Resources, Groundwater Resources Reconnaissance Series, Report 8.

Eakin T.E., and R.D. Lamke, 1966. *Hydrologic Reconnaissance of the Humboldt River Basin, Nevada.* Nevada Department of Conservation and Natural Resources, Bulletin No. 32.

Eklund, Joyce, Elko County Board of Realtors. Personal communication, November 25, 1992.

Elko Chamber of Commerce. City of Elko Profile.

Elko County School District. Summary of Enrollment, 1986-87 to 1992-93.

Elko Daily Free Press, February 2, 1993.

Elliott, Bert A., Director of Instruction, Elko County School District. Personal communication, October 26, 1992.

*Environmental Research and Technology, Inc., 1979a. *Geology and Minerals Technical Report for the Jerritt Canyon Project.* Fort Collins, CO.

*Environmental Research and Technology, Inc., 1979b. *Vegetation Technical Report for the Jerritt Canyon Project.* Fort Collins, CO.

*Environmental Research and Technology, Inc., 1979c. *Air Quality Portion of the Free Port Jerritt Canyon Project Environmental Impact Statement.* Westlake Village, CA.

*Environmental Research and Technology, Inc., 1979d. *Surface Water Technical Report for the Jerritt Canyon Project.* Fort Collins, CO.

---

*This document is incorporated by reference into the FEIS

*Environmental Research and Technology, Inc., 1979e. *Visual Quality and Recreation Technical Report for the Jerritt Canyon Project.* Fort Collins, CO.

*Environmental Research and Technology, Inc., 1979f. *Aquatic Biology Technical Report for Jerritt Canyon Project.* Fort Collins, CO.

*Environmental Research and Technology, Inc., 1979g. *Water Quality Technical Report for Jerritt Canyon Project.* Fort Collins, CO.

*Environmental Research and Technology, Inc., 1979h. *Soils Technical Report for Jerritt Canyon Project.* Fort Collins, CO.

*Environmental Research and Technology, Inc., 1979i. *Wildlife Technical Report for Jerritt Canyon Project.* Fort Collins, CO.

ERT - See Environmental Research and Technology.

ENSR Consulting and Engineering, 1991. *Socioeconomic Technical Report for the Betze Project Environmental Impact Statement.*

Fala, R.A., and G.R. Bieri. 1979. *Reclaiming the Land.* Wyoming Wildlife 43: 28-31.

*Freeport Gold Company, 1980. *Plan of Operations, Jerritt Canyon Mine.*

*Freeport Gold Company, 1984. *Revised Plan of Operations, Jerritt Canyon Mine,* Freeport Gold Company.

Geological Society of Nevada, 1992. *The 1992 Geological Society of Nevada Field Trip Guidebook.*

GeoResearch, Inc., 1993. *Order 3 Soil Survey Maps of Project Area, Jerritt Canyon Mine Expansion EIS.*

*Gibson & Skordal, 1992. *Part II, Delineation of Waters of the United States, Other Than Adjacent and Isolated Wetlands, of Independence Mining Company Project Areas.*

Gray, Ken, Wildlife Biologist, NDOW. Personal communication, August 1993.

*Hawkins, Robert B., Idaho State University Thesis, 1973. *The Geology and Mineralization of the Jerritt Creek Area, Northern Independence Mountains, Nevada.* Unpublished Masters Thesis. Idaho State University.

HCI - See Hydrologic Consultants, Inc.

Hess - See NDOW, 1992a and 1993.

This document is incorporated by reference into the FEIS

Hydro-Geo Consultants, Inc., 1993. *Technical Memorandum, Preliminary Hydrogeologic Study Summary, New Deep/Underground Mine, Jerritt Canyon Project.* Lakewood, CO.

Hydrologic Consultants, Inc., 1993. *Hydrogeologic Investigation of New Deep Deposit and Estimate of Potential Inflows to Pit.* Lakewood, CO.

IMC - See Independence Mining Company Inc.

*IME Wetlands Consultants, 1992. *Part III, Delineation of Isolated and Adjacent Wetlands of Independence Mining Company Project Areas, Elko County, NV.*

*Independence Mining Company Inc., 1992a. *Jerritt Canyon Project Plan of Operations for Burns Basin Pit, Dump and Haul Roads (Amendment #26 to POO #400-80-Rev.1).*

*Independence Mining Company Inc., 1992b. *Jerritt Canyon Project Plan of Operations for Winters Creek Pit, Dump and Haul Roads (Amendment #26 to POO #400-80-Rev.1).*

*Independence Mining Company Inc., 1992c. *Jerritt Canyon Project Plan of Operations for Alchem C Dump and Haul Road (Amendment #25 to POO #400-80-Rev.1).*

*Independence Mining Company Inc., 1992d. *Part I, Delineation of Waters of the United States.* Elko County, NV.

Independence Mining Company Inc., 1992e. *1992 Annual Work Plan, July 15, 1992.* Elko County, NV.

Independence Mining Company Inc., 1992f. *Pre-discharge Notification, Jerritt Canyon Project Area.*

Independence Mining Company Inc., 1992g. *Information Handbook.*

*Independence Mining Company Inc., 1993a. *Jerritt Canyon Mine Expansion Plan of Operations (POO #400-80-Rev.4).*

Independence Mining Company Inc., 1993b. *Information Handbook.*

Independence Mining Company Inc., 1993c. *Memorandum Regarding Evaluation of Geologic Hazards within Mine Expansion Areas*

Independence Mining Company Inc., 1993d. *Annual Work Plan, July 15, 1993.* Elko County, NV.

Independence Mining Company Inc., 1993e. *Revised Mitigation Plan for the Jerritt Canyon Project Area, Elko County, Nevada.*

This document is incorporated by reference into the FEIS

Independence Mining Company Inc., 1993f. *Department of the Army Permit for the Discharge of Fill Materials to "Waters of the United States" within the Jerritt Canyon Project Area.* Elko, Nevada.

Independence Mining Company Inc., 1994. *Memorandum Regarding Jerritt Canyon Project Reclamation.*

*Independence Mining Company Inc. and IME Wetlands Consultants, March 1993. *"Waters of the United States Delineation."* Jerritt Canyon Project Area, Saval/Steer Study Area, Elko County, NV and Yampa, CO.

*J. W. Patterson & Associates, Inc., 1985. *Water Resource & Water Quality Evaluation for the Burns Basin Environmental Assessment.*

*JBR Consultants Group, 1992. *Threatened, Endangered, & Sensitive Plant Survey, Independence/Bull Run Mountains.* Reno, NV.

*JBR Consultants Group, 1993a. *Threatened, Endangered, & Sensitive, Wildlife Survey, Independence/Bull Run Mountains.* Reno, NV.

*JBR Consultants Group, 1993b. *Threatened, Endangered, & Sensitive Species, Literature Search, Independence/Bull Run Mountains.* Reno, NV.

*JBR Consultants Group, 1993c. *Golden Eagle Nest Survey, Southern Independence Mountains.* Reno, NV.

Jarvie, Verl, Assistant Fire Marshall, City of Elko. Personal communication, October 27, 1992.

Johnson, Mike, Elko County Assessor's Office. Personal communication, March 1, 1993.

Keister, Rick, National Association of Counties, Washington, D.C. Telephone interview, June 10, 1993.

Keister, Rick. National Association of Counties, Washington, DC. Telephone interview. June 11, 1993.

Kennedy/Jenks Consultants, 1993a. Addendum No. 1 to Waste Dump Slope Stability Calculations for Proposed Saval, Steer, and New Deep Waste Rock Dumps, Jerritt Canyon Mine, Nevada, Unpublished company report, June 1, 1993.

Kennedy/Jenks Consultants, 1993b. Salvageable Growth Medium Calculation for Saval/Steer and New Deep. Reno, NV.

Kennedy/Jenks Consultants, 1993c. Waste Dump Slope Stability Calculations for Proposed Saval, Steer, and New deep Waste Rock Dumps, Jerritt Canyon Mine, Nevada, Unpublished company report, June 1, 1993.

Kennedy/Jenks Consultants, 1993d. Memorandum to Matt Thiel, Independence Mining Company Inc.

Knight, Peisold and Co., 1988. Freeport McMoRan Gold Company, Jerritt Canyon Project, Tailings Storage Facility Final Design Report, Unpublished company report.

Knight, Peisold and Co., 1991. Independence Mining Company Inc., Jerritt Canyon Project, Tailings Storage Facility Phase IV Expansion Final Design Report, Unpublished company report.

Knutson, Terri, BLM, Elko District Office. Personal communication, July 26, 1993.

Kuchler, 1975. *Vegetation Types of North America.*

Ladd, Leroy, Lieutenant, City of Elko Police Department. Personal communication, October 26, 1992.

Lake, L. Personal communication. June 1993.

Lamp, Rory, Biologist, NDOW. Letter to Jack Carlson, August 10, 1993.

Lamp, Rory, Biologist, NDOW. Personal communication, September, 1993.

Lipparelli, Lorry, City Manager, City of Elko. Personal communication, October 26, 1992.

Loope, L.L., 1969. *Subalpine and Alpine Vegetation of Northeastern Nevada.* Unpublished PhD dissertation, Duke University.

McAdoo, 1981. Mist Net Survey.

McAdoo, 1993. Personal communication.

McDade, Joe, Administrative Officer, Bureau of Indian Affairs, Elko Office. Personal communication, October 27, 1992.

*Moen Associates, 1979a. *Cultural Resources of the Jerritt Canyon Project, An Appendix to Phase One, Final Report.* Las Vegas, NV.

*Moen Associates, 1979b. *Cultural Resources of the Jerritt Canyon Project, Phase One, Final Report.* Las Vegas, NV.

This document is incorporated by reference into the FEIS

*Moen Associates, 1979c. *Cultural Resources of the Jerritt Canyon Project, Phase Two*. Las Vegas, NV.

*Moen Associates, 1980. *Cultural Resources of the Jerritt Canyon Project*. Las Vegas, NV.

Moore, Lou, Coordinator, Elko Federal Land Use Planning Board. Personal communication, April 6, 1993.

Moss, Daryl, Assistant City Engineer, City of Elko. Personal communication, October 27, 1992.

*Murray, Don, 1988. *Soils Report of the Winter's Creek Mining Proposal.*

Naroll, Maud, State Demographer, Bureau of Business and Economic Research, University of Nevada-Reno. Personal communication, May 10, 1993.

National Academy of Sciences, 1979. *Surface Mining of Non-Coal Minerals, A Study of Mineral Mining from the Perspective of the Surface Mining Control and Reclamation Act of 1977*. Washington, D.C.

Nevada Department of Conservation and Natural Resources, 1973. *Abstract of Water Filings, South Fork Owyhee River Areas No. 35 and 36*. Water Resources Division, Elko, NV.

Nevada Department of Highways. *Permit Regulations For Operations of Over-Dimensional Vehicles and Loads on Nevada Highways.*

Nevada Department of Minerals, 1993. *Production Figures for Major Mines in Nevada for 1992.*

Nevada Department of Minerals and the Nevada Bureau of Mines and Geology, 1992. *Major Mines of Nevada 1991*, Special Publication P-3. Carson City, NV.

Nevada Department of Motor Vehicles and Public Safety. *Nevada Hazardous Material / Waste Transportation Permit Application.*

Nevada Department of Taxation and Nevada State Demographer, 1992. *Population of Nevada's Counties and Incorporated Cities, 1981 through 1992 State Estimates*. Bureau of Business and Economic Research, College of Business Administration, University of Nevada, Reno.

Nevada Department of Wildlife, 1992a. *Big Game Status and Quota Recommendations*, (Hess).

Nevada Department of Wildlife, 1992b. *Upland Game, Furbearers, Mountain Lion and Migratory Game Birds. Status and Hunting Season Recommendations, (Retterer).*

Nevada Department of Wildlife, 1993. *Big Game Status and Quota Recommendations*, (Hess).

Nevada Division of Environmental Protection, 1990. *Waste Rock and Overburden Evaluation.*

Nevada Division of Environmental Protection, November 2, 1990. *Interim Guidance Beneficiation Waste Disposal.*

Nevada Division of Environmental Protection, 1992. *(319) Nonpoint Source Pollution Assessment Report on Snake River Basin.* Department of Conservation and Natural Resources, Bureau of Water Quality Planning.

Nevada State Demographer, 1993. *Nevada Population Estimates (1992) and Forecasts (1993-1998).* Bureau of Business and Economic Research, College of Business Administration, University of Nevada, Reno.

North East Nevada Development Authority, 1992a. *A Business Portrait of Northeast Nevada.*

North East Nevada Development Authority, 1992b. Elko County, Nevada brochure.

Peterson, Dennis, Building Official, City of Elko. Personal communication, October 27, 1992.

Peterson, Robert et al, 1993. *A Class III Cultural Resource Inventory of the Independence Mining Company, Jerritt Canyon Project, Volume I.*

Puchlik, Lorri, Director, Elko Chamber of Commerce. Personal communication, October 27, 1992.

Ramsey, Katherine, Humboldt National Forest, Personal communication, February 8, 1994.

Ritter, Linda, Comptroller, Elko County. Personal communication, October 14, 1992.

Riverside Technology, Inc., 1990. *Groundwater Technical Memorandum for the Winters Creek Project.* Fort Collins, CO.

Salicchi, Caesar, Elko County Treasurer's Office. Personal communication, March 2, 1993.

Schafer and Associates, 1994. *Final Geochemical Characterization Report: New Deep, Saval-Steer and Burns Basin Waste Rock.*

Schaffran, Gary, Humboldt National Forest. Personal communication.

*This document is incorporated by reference into the FEIS

Schmauch, S. W., Gabby, P. N., and Lipton, D. A., 1992. *Mineral Resources of the Independence Range Special Study Area, Elko County, Nevada.* U. S. Department of the Interior, Bureau of Mines Mineral Land Assessment Open File Report No. MLA 17-92, Western Field Operations Center, Spokane, WA.

SCS - See USDA, Soil Conservation Service.

Sergent, Hauskins & Beckwith, 1979. *Ground Water Technical Report for Jerritt Canyon Project.* Phoenix, AZ.

Songer, Bob, Chief, City of Elko Police Department. Personal communication, October 26, 1992.

Steele, B.B., and C.V. Grant. 1981. *Topographic diversity and islands of natural vegetation; aids in re-establishing bird and mammal communities on reclaimed lands.* Reclamation and Revegetation Research 1: 367-381.

*Steffen, Robertson & Kirsten, Inc., 1983a. *Geotechnical Investigations and Stability Analyses for Waste Dumps for Alchem, Ridge, South, West Generator, Snow Canyon East, and West Waste Dumps at Jerritt Canyon Mine.* Lakewood, CO.

*Steffen, Robertson & Kirsten, Inc., 1983b. *Overview Report on Waste Dump Stability and Layouts for Alchem, Ridge, South, West Generator, Snow Canyon East, and West Waste Dumps at Jerritt Canyon Mine.* Lakewood, CO.

Stiver, San J., Nevada Department of Wildlife, 1993a. *Early Upland Game Turkey, Band-Tailed Pigeon, Mourning Dove and Special Falconry. Status and Hunting Season Recommendations.*

Stiver, San J., Nevada Department of Wildlife, 1993b. *Nevada Upland Game, Furbearers, Mountain Lion and Migratory Game Birds. Status and Hunting Season Recommendations.*

Torell, L. A., Nevada Ag Exp. Station, 1985. *Optimal Livestock Production Strategies on the Saval Ranch.*

U.S. Bureau of the Census. 1980 Census of Population and Housing, Summary Tape Files 1A and 3A.

U.S. Bureau of the Census. 1990 Census of Population and Housing, Summary Tape Files 1A and 3A.

U.S. Department of Labor, 1992. *Bureau of Labor Statistics, Employment and Earnings.* Information Please Almanac, Atlas and Yearbook, 1993; Ed. by Dan Galenpaul. Boston, MA.

U.S. Environmental Protection Agency, 1986. Office of Water Regulations and Standards, *Quality Criteria for Water.* Washington, DC.

This document is incorporated by reference into the FEIS

*USDA, Forest Service, a, (undated). *Environmental Consequences of the Proposed Burns Basin Mine Project on the Soil Resource.*

*USDA, Forest Service, b, (undated). *Fish / Wildlife Technical Report for Winter's Creek Mine Proposal.*

*USDA, Forest Service, c, (undated). *Soils Inventory of the Burns Basin Project.*

*USDA, Forest Service, d, (undated). *Vegetation Technical Report for Winter's Creek Mine Proposal.*

USDA, Forest Service, e, (undated). *Saval Ranch Research and Evaluation Project, Notes on Climatological Studies, Precipitation data for Saval Ranch.*

USDA, Forest Service, f, (undated). *Unpublished Landtype Association Survey of the Independence Mountains Area.* Humboldt National Forest, Elko, NV.

USDA, Forest Service, g, (undated). *Unpublished Soil Data and Maps of the Independence Mountains Area.* Humboldt National Forest, Elko, NV.

*USDA, Forest Service, h, (undated). *Jerritt Canyon Project Plans of Operations and Subsequent Amendments.*

*USDA, Forest Service, 1980. *Final Environmental Impact Statement, Jerritt Canyon Project, Gold Mine and Mill*, Elko County, NV.

USDA, Forest Service, 1982. *Saval Ranch Research and Evaluation Study Progress Report.*

USDA, Forest Service, 1983. *Saval Ranch Research and Evaluation Study Progress Report.*

*USDA, Forest Service, 1984. *Environmental Assessment, Report for the Freeport Waste Dump Proposal.*

*USDA, Forest Service, 1985a. *Geology Report for Burns Basin Mine Proposal.*

*USDA, Forest Service, 1985b. *Rangeland and Livestock Management Resources Report for Burns Basin Mine Proposal.*

*USDA, Forest Service, 1985c. *Wildlife Resource Report, Burns Basin Mine Proposal.*

*USDA, Forest Service, 1985d. *Vegetation Report for Burns Basin.*

*USDA, Forest Service, 1986a. *Humboldt National Forest Land and Resource Management Plan Final Environmental Impact Statement.* Elko County, NV.

This document is incorporated by reference into the FEIS

*USDA, Forest Service, 1986b. *Humboldt National Forest Land and Resource Management Plan.*

*USDA, Forest Service, 1986c. *Environmental Assessment, Burns Basin.*

USDA, Forest Service, 1987. *Ecosystem Classification Handbook, Chapter 4, Ecodata Sampling Methods.*

USDA, Forest Service, 1988. *Riparian Category Ratings,* Humboldt National Forest.

*USDA, Forest Service, 1990. *Environmental Assessment, Jerritt Canyon Mine Expansion, the Winters Creek Project.*

USDA, Forest Service, June 1991. Mountain City Ranger District, Bird Census Conducted on Mill Creek.

*USDA, Forest Service, 1991a. *Environmental Assessment, Mahala Creek, North California Mountain, and Greenstone Draw Exploration Projects.*

*USDA, Forest Service, 1991b. *Environmental Assessment, Wright Window and Gracie Exploration Proceeds,* Elko County, NV.

*USDA, Forest Service, 1991c. *Forest Service Handbook, Intermountain Region Guidelines,* Elko County, NV.

*USDA, Forest Service, 1992a. *Technical Guide, The Independence Range Cumulative Effects Analysis (CEA).*

*USDA, Forest Service, 1992b. *Environmental Assessment, Alchem C Dump.* Elko County, NV.

USDA, Forest Service, 1992c. Water resource files. Humboldt National Forest Supervisor's Office, Elko, NV.

*USDA, Forest Service, 1993a. *Environmental Assessment, California Mountain Mine.* Elko, NV.

USDA, Forest Service 1993b. Forest Service Handbook 2209.13 as amended.

USDA, Forest Service and Nevada Department of Fish and Game, 1978. *Stream Habitat Condition Survey.*

*USDA, Forest Service, Nevada Department of Wildlife, and Independence Mining Company Inc., March 31, 1993. *Memorandum of Understanding on Mule Deer.*

**This document is incorporated by reference into the FEIS*

*USDA, Forest Service and USDI, Bureau of Land Management, 1979. *Summary Preliminary Draft Socioeconomic Component Draft Environmental Impact Statement, Jerritt Canyon Project*. Elko County, NV.

USDA, Soil Conservation Service. *Advance Soil Survey Data*, Elko County, Nevada, North-Central Part (Saval Planning Unit), March 1979.

USDA, Soil Conservation Service, 1986. *Soil Survey Elko County*, Central Park, Elko County, NV.

USDI, Bureau of Land Management, 1984. *Saval Ranch Research and Evaluation Project Progress Report*. Renewable Resource Center, Reno, NV.

USDI, Bureau of Land Management, 1985. *Saval Ranch Research and Evaluation Project Progress Report*.

*USDI, Bureau of Land Management, 1986a. *Proposed Resource Management Plan and Final Environmental Impact Statement*, Elko Resource Area. Elko District Office.

*USDI, Bureau of Land Management, 1986b. *Environmental Assessment, EA NV-010-6-006, Freeport Leach Pads*.

USDI, Bureau of Land Management, 1986c. *Saval Ranch Research and Evaluation Project Progress Report*.

*USDI, Bureau of Land Management, March 1987. *Elko Resource Management Plan Record of Decision*. Elko District Office.

USDI, Bureau of Land Management, 1988. *Saval Ranch Research and Evaluation Project Final Report*.

*USDI, Bureau of Land Management, 1989. *Final Environmental Assessment, Expansion of Jerritt Canyon Project*. Gold Mine and Mill, Elko County, Nevada. Elko District Office.

*USDI, Bureau of Land Management, 1991a. *Decision Record - Jerritt Canyon Mine Expansion, Environmental Assessment*.

*USDI, Bureau of Land Management, 1991b. *Environmental Assessment for the Jerritt Canyon Project Tailings Pond Dam Raises*. Elko District Office.

USDI, Bureau of Land Management, 1992. *Saval Ranch Strutting Ground Counts*.

*USDI, Bureau of Land Management, 1993. *Environmental Assessment BLM/EK/PL-93/027, Jerritt Canyon Project New Tailings Facilities*. Elko District Office.

This document is incorporated by reference into the FEIS

USDI, Bureau of Mines, *Mineral Land Assessment Open File Report No. MLA 17-92*. (See Schmauch, S.W. et. al.).

U.S. Environmental Protection Agency, 1987. Office of Water Regulations and Standards, *Update Number 2 to Quality Criteria for Water, 1986*. Washington, DC.

U.S. Geological Survey, 1992. Water resources data. Nevada State Office, Carson City, NV.

USFS - See USDA, Forest Service

Warder, Jon. USFS, Mountain City Ranger District, Mountain City, Nevada. Telephone interview, 1993.

Watson, C., Lieutenant, Elko County Sheriff's Department. Personal communication, September 2, 1992.

Whalen, Bonnie, Humboldt National Forest, Personal communication, April 20, 1993.

Winschmeier, W. H., and Smith, D. D., 1978. *Predicting Rainfall Erosion Losses - A Guide to Conservation Planning*, U. S. Department of Agriculture Agricultural Handbook No. 437, GPO, Washington, DC.

Younk, James, 1991. *Preliminary Report, 1991 Field Season, Northern Goshawk Study, Independence Mountains, Nevada.* Raptor Research Center, Department of Biology, Boise State University. Boise, ID.

Younk, James, 1992. *Preliminary Report, 1992 Field Season, Northern Goshawk Study, Independence Mountains, Nevada.* Raptor Research Center, Department of Biology, Boise State University. Boise, ID.

Younk, James. Personal communication, 1993.

GLOSSARY

Acid Rock Drainage - Drainage with a pH of 2.0 to 4.5 from mines and mine wastes that is the result of oxidation of sulfides exposed during mining.

Acre-feet - The volume of liquid or solid required to cover one acre to a depth of one foot, or 43,560 cubic feet; measure for volumes of water, reservoir rock, etc.

Activated Carbon - Highly adsorbent carbon formed by heating granulated charcoal to exhaust contained gases.

Ad valorem tax - Property tax.

Adit - A nearly horizontal passage in an underground mine, driven from the surface, by which a mine may be entered, ventilated, and/or dewatered.

Allotment - A unit of land suitable and available for livestock grazing that is managed as one grazing unit.

Alluvium - Unconsolidated or poorly consolidated gravel sands and clays, deposited by streams and rivers on riverbeds, floodplains, and alluvial fans.

Ambient - The environment as it exists at the point of measurement and against which changes or impacts are measured.

Angle of Repose - The maximum angle of slope at which loose, cohesionless material remains stable. It commonly ranges between 33° and 37° on natural slopes.

Animal Unit Months (AUMs) - Grazing of a cow/calf pair for one month.

Anomaly - A geological feature, especially in the subsurface, distinguished by geological, geophysical, or geochemical means, which is different from the general surroundings.

Aquatic Bed - An area that is submerged most of the time, supports submerged vegetation and can be periodically exposed.

Aquatic Resources - Biological resources (plants, animals, and other life forms) present in or dependent on streams, lakes, and other surface water.

Aquifer - A body of rock that is sufficiently permeable to conduct groundwater and to yield economically significant quantities of water to wells and springs.

Argillite - A compact rock, derived from mudstone or shale, more highly indurated than either of those rocks.

Aspect - The direction toward which a slope faces with respect to the compass or the sun.

Assemblage - A group of rocks grouped together by age or similar origin.

Background - The viewing area of a distance zone that lies beyond the foreground-middleground. Usually from a minimum of 3 to 5 miles to a maximum of about 15 miles from a travel route, use area, or other observer position. Atmospheric conditions in some areas may limit the maximum to about 8 miles or increase it beyond 15 miles.

Baseline Study - A study conducted to gather data prior to mining for the purpose of outlining conditions existing on an undisturbed site. Impacts are evaluated against the baseline data and reclamation success is measured against baseline data.

Biota - The animal and plant life of a region; flora and fauna collectively.

Broadcast seeding - Distribution of seed by a fan spreader or by hand spreading.

Carbonation - An alteration process that involves precipitation of dissolved calcium carbonate as veins and veinlets.

CFR - Code of Federal Regulations, the compilation of federal regulations adopted by federal agencies through a rule-making process.

Characteristic Landscape - The established landscape within an area being viewed. The term does not necessarily mean a naturalistic character, but may refer to features of the cultural landscape, such as a farming community, an urban landscape, or other landscape that has an identifiable character.

Chert - A sedimentary rock composed of cryptocrystalline quartz.

Collar - The mouth or upper end of a mine shaft.

Colluvium - General term applied to loose and incoherent deposits, usually at the foot of a slope of cliff and brought there chiefly by gravity; such as talus and cliff debris.

Community Types (vegetation) - A group of plants living in a specific region under relatively similar conditions.

Contrast - The effect of a striking difference in the form, line, color, or texture of the landscape features within the area being viewed.

Critical Habitat - Habitat that is present in minimum amounts and is the determining factor in the potential for population maintenance and growth.

Crosscut - Level passage that connects drifts in an underground mine.

Cultural Resources - The archaeological and historical remains of human occupation or use. Includes any manufactured objects, such as tools or buildings. May also include objects, sites, or geological/geographical locations significant to Native Americans.

Cumulative Effects - The combined environmental impacts that accrue over time and space from a series of similar or related individual actions, contaminants, or projects. Although each action may seem to have a negligible impact, the combined effect can be significant. Included are activities of the past, present, and reasonably foreseeable future.

dBA - The sound pressure levels in decibels measured with a frequency weighing network corresponding to the A-scale on a standard sound level meter. The A-scale tends to suppress lower frequencies, e.g., below 1,000 Hz.

Decibel (dB) - A unit used in expressing ratios of electric or acoustic power. The relative loudness of sound.

Direct Impacts - Impacts which are caused by the action and occur at the same time and place (40 CFR 1508.7). Synonymous with direct effects.

Discharge - The volume of water flowing past a point per unit time, commonly expressed as cubic feet per second (cfs), gallons per minute (gpm), or million gallons per day (mgd).

Disturbed Area - Area where natural vegetation and soils have been removed or disrupted.

Diurnal Surface Wind - Daily variation between night and day in the direction of flow and speed of surface wind.

Dore Bars - Metal alloy composed of gold, silver, and other precious metals. Bullion containing unparted metallic gold and silver.

Drainage - Natural channel through which water flows some time of the year. Natural and artificial means for effecting discharge of water as by a system of surface and subsurface passages.

Drawdown - The lowering of the water level in a well as a result of withdrawal.

Drift - Level passage that follows the ore in an underground mine.

Earthquake - Sudden movement of the earth's crust resulting from faulting, volcanism, or other mechanisms.

Ecological Site - Subdivisions of rangeland differentiated by the potential natural vegetation they are capable of supporting.

Endangered Species - Any species in danger of extinction throughout all or a significant portion of its range. Plant or animal species identified by the Secretary of the Interior as endangered in accordance with the 1973 Endangered Species Act.

Ephemeral Stream - A stream or portion of a stream that flows briefly in direct response to precipitation in the immediate vicinity, and whose channel is at all times above the water table.

Epicenter - The location of the earth's surface directly above the focus or origin of an earthquake.

Erosion - The wearing away of soil and rock by weathering, mass wasting, and the action of streams, glaciers, waves, wind, and underground water.

Evapotranspiration (ET) - The portion of precipitation returned to the air through evaporation and plant transpiration.

Exploration - The search for economic deposits of minerals, ore, and other materials through practices of geology, geochemistry, geophysics, drilling, and/or mapping.

Fault - A fracture or one of fractures in rock units along which there has been displacement of the sides relative to one another parallel to the fracture.

Fisheries - Streams and lakes used for fishing.

Floodplain - That portion of a river valley, adjacent to the channel, which is built of sediments deposited during the present regimen of the stream and is covered with water when the river overflows its banks at flood stages.

Flume - A structure built in an open channel that constricts water flow through a designed opening to measure rate of water flow.

Footprint - The actual surface area physically disturbed by mining operations and ancillary facilities.

Footwall - The underlying side of a fault, orebody, or mine working. The wall rock beneath an inclined vein or fault.

Forage - Vegetation used for food by wildlife, particularly big game wildlife and domestic livestock.

Forb - Any herbaceous plant other than a grass, especially one growing in a field or meadow.

Foreground-Middleground - The area visible from a travel route, use area, or other observer position to a distance of 3 to 5 miles. The outer boundary of this zone is defined as the

point where the texture and form of individual plants are no longer apparent in the landscape, and vegetation is apparent only in pattern or outline.

French Drain - A water passage made by filling a trench or foundation area with loose stones or rock and covering with earth or other materials.

Fugitive Dust - Dust particles suspended randomly in the air from road travel, excavation, and rock loading operations.

g - The force of gravity at the earth's surface or at sea level.

Game Species - Animals commonly hunted for food or sport.

Geochemistry - The study of the distribution and amounts of the chemical elements in minerals, ores, rocks, soils, water, and the atmosphere, and their circulation in nature, on the basis of the properties of their atoms and ions.

Geotechnical - A branch of engineering concerned with the engineering design aspects of slope stability, settlement, earth pressures, bearing capacity, seepage control, and erosion.

Grade - A slope stated in terms of feet per mile or as feet per feet (percent); the content of precious metals per volume of rock (ounces per ton).

Graminoid - Grasses or grain-bearing plants.

Ground Cover - The amount of ground surface covered by vegetation.

Ground Water - All subsurface water, especially that as distinct from surface water portion in the zone of saturation.

Ground Water Table - The surface between the zone of saturation and the zone of aeration; that surface of a body of unconfined ground water at which the pressure is equal to that of the atmosphere.

Growth Medium - Topsoil with sufficient organic matter and nutrients to support plant life.

Habitat - The place or type of site where a plant or animal naturally or normally lives and grows. Includes all biotic, climatic, and soils conditions, or other environmental influences affecting living conditions.

Hanging Wall - The overlying side of an orebody, fault, or mine working. The wall rock above an inclined vein or fault.

Haul Road - All roads utilized for transport of an extracted mineral, waste, overburden, or other earthen materials.

Heap Leach - The process of recovering gold from low-grade ores by leaching ore that has been mined and placed on a specially prepared pad. A dilute sodium cyanide solution is applied through low-volume emitters and, the metal-bearing leachate solution percolates and is collected.

Heavy Metals - A group of elements that may be acquired by organisms in trace amounts that are toxic in higher concentrations. Includes copper (Cu), lead (Pb), mercury (Hg), molybdenum (Mo), nickel (Ni), cobalt (Co), chromium (Cr), iron (Fe), silver (Ag), etc.

Herbaceous Perennials - Leafy, non-woody plants with fleshy stems that have a life span of more than two years.

Host Rock - A body of rock serving as a host for mineral deposits.

Hydrology - A science that deals with the properties, distribution, and circulation of surface and subsurface water.

Hydrophitic Vegetation - Plants that grow in and are adapted to an aquatic or very wet environment.

Hydrostatic Head - The height of a vertical column of water, the weight of which, if of unit cross-section, is equal to the hydrostatic pressure at a point.

Igneous - Rock or mineral that solidified form molten or partly molten magma, processes relating to or resulting from the information of such rocks.

Impoundment - The accumulation of any form of water in a reservoir or other storage area.

Incised Streams - Streams that have deep channels and high, steep banks due to erosion.

Inclined Shaft - A passage in an underground mine inclined from vertical to 45° or less.

Indirect Impacts - Impacts which are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable. (40 CFR 1508.8). Synonymous with indirect effects.

Infiltration - The movement of water or some other liquid into the soil or rock through pores or other openings.

Infrastructure - The basic framework or underlying foundation of a community including road networks, electric and gas distribution, water and sanitation services, and facilities.

Intermittent Stream - 1) A stream that flows only at certain times of the year, as when it receives water from springs or from a surface source; and 2) a stream that does not flow continuously, as when water losses from evaporation or seepage exceed the available stream flow.

Irreversible - Applies primarily to the use of nonrenewable resources, such as minerals, cultural resources, wetlands, or to those factors that are renewable only over long time spans, such as soil productivity. Irreversible also includes loss of future options.

Jurisdictional Wetland - A wetland area identified and delineated by specific technical criteria, field indicators, and other information for purposes of public agency jurisdiction. The public agencies which administer jurisdictional wetlands are the US Army Corps of Engineers, US Environmental Protection Agency, US Fish and Wildlife Service, and USDA-Soil Conservation Service.

Land Use - Land uses determined for a given area that establish the types of activities allowed (e.g., mining, agriculture, timber production, residences, industry) and the size of buildings and structures permitted.

Landform - Any physical, recognizable form or feature of the Earth's surface, having a characteristic shape and produced by natural causes. Includes major features such as plains, plateaus, and mountains, and minor features, such as hills, valleys, slopes, canyons, arroyos, and alluvial fans.

Landscape Character - The arrangement of a particular landscape as formed by the variety and intensity of the landscape features as defined as the four basic elements (form, line, color, and texture). These factors give the area a distinctive quality that distinguishes it from its immediate surroundings.

Landscape Features - The land and water forms, vegetation, and structures that compose the characteristic landscape.

Lifts - Changes in slopes on the faces of waste rock or heaps that are the result of construction of the dump or heap in a series of layers.

Lithic Scatter - (Archaeology): A discrete grouping of flakes of stone created as a byproduct in the tool-making process. Often includes flakes used as tools as well as formal stone tools, such as projectile points, knives, or scrapers.

Lithology - The description of rocks in terms of the physical character of a rock, mineral composition, grain size, color and other physical characteristics.

Maximum Modification - A visual quality objective that allows activities that alter the vegetation and landform to dominate the original characteristic landscape with some limitations.

Mesic - Moist habitats associated with springs, seeps and riparian areas.

Mill feed - The supply of mined ore transported to the mill for processing.

Milling - The general process of separating the economic constituents (metals) from the undesired or un-economic constituents of ore material (tailings).

Mineralization - The process by which a valuable mineral or minerals are introduced into a rock.

Mining Claims - That portion of the public estate held for mining purposes in which the right of exclusive possession of locatable mineral deposits is vested in the locator.

Mitigate, Mitigation - To cause to become less severe or harmful to reduce impacts. Actions to avoid, minimize, rectify, reduce or eliminate, and compensate for impacts to environmental resources.

Modification - A visual quality objective in which man's activity may dominate the characteristic landscape, but should appear as a natural occurrence when viewed as background.

Monitor - To systematically and repeatedly watch, observe or measure environmental conditions in order to track changes.

Muck - (1) Broken ore and rock. (2) The process of removing broken waste rock.

Multiple Use - The management concepts under which National Forest System lands are managed that involve the management of resources in combinations that will best serve the public.

National Pollutant Discharge Elimination System (NPDES) - NPDES is a part of the Clean Water Act, which requires point source dischargers to obtain permits. These permits are referred to as NPDES permits and are administered by the Environmental Protection Agency.

National Register of Historic Places - A list, maintained by the National Park Service, of areas which have been designated as being of historical significance.

Native Species - Plants that originated in the area in which they are found, i.e., they naturally occur in that area.

NEPA - The National Environmental Policy Act of 1969. It is the national charter for protection of the environment. NEPA establishes policy, sets goals, and provides means for carrying out the policy. Regulations at 40 CFR 1500-1508 implement the act.

Net Proceeds Tax - This is a form of income tax assessed as a property tax intended to assess the value of the minerals which are being extracted.

Nutrients - Essential chemicals needed by plants or animals for growth and health. If other physical and chemical conditions are optimal, excessive amounts of nutrients can lead to

degradation of water quality by promoting excessive growth, accumulation and subsequent decay of plants, especially algae. Some nutrients can be toxic to animals in high concentrations.

Ordinary high water mark (OHWM) - line on the shore established by the fluctuation of water and indicated by physical characteristics such as a clear, natural line impressed on the bank, shelving, changes in the character of soil, destruction of terrestrial vegetation, the presence of litter and debris, or other appropriate means that consider the characteristics of the surrounding areas

Ore - A deposit of rock from which a valuable mineral or minerals can be economically extracted.

Organic Administration Act of 1897 - Act which provides the authority for the Forest Service to administer reserved and outstanding mineral operations in conjunction with the Secretary of Agriculture. The law specifically authorizes the Forest Service to manage the surface resources on National Forest System lands. It also provides a) the right to conduct mining activities and b) the right of ingress and egress on National Forest System lands to conduct mineral activity.

Overburden - Material which overlies a deposit of valuable material.

Overstory - That portion of the trees, in a forest of more than one story, forming the upper or uppermost canopy.

Paleontology - The study of the forms of life existing in former geologic periods, as represented by fossil animals and plants.

Partial Pit Backfill - Placing waste rock in a mined-out pit to less than the capacity of the pit.

Partial Retention - A visual quality objective in man's activities may be evident, but must remain subordinate to the characteristic landscape.

Patent - A document conveying title to land from the U. S. Government to private ownership.

Patented Claims - Private land which has been secured from the U. S. Government by compliance with laws relating to such lands.

Perched Water - Unconfined groundwater separated from the underlying main body of groundwater by unsaturated rock.

Perennial Stream - A streamor reach of a stream that flows throughout the year.

Permeable - The property or capacity of a porous rock, sediment, or soil to transmit a liquid.

pH - The negative $\log_{10}$ of the hydrogen ion activity in solution; a measure of acidity or basicity of a solution.

Phenologically - Relating to biological phenomena such as flowering, breeding, and migration, especially in conjunction with variation in climate.

Pillars - Ore or rock material used to support the walls or ceiling in an underground operation.

Plan of Operations - As required by 36 CFR 228.4: Plan of operations submit outlines to the USFS by the operator that include: the name and address of the operator, location of the proposed area of operations; and information sufficient to describe the type of operations proposed, the type and stands of roads, the means of transportation used, the period when the proposal will take place, and measures to be taken to meet the requirements for environmental protection.

Peak Flow - The greatest flow attained during melting of winter snowpack or during a large precipitation event.

Portal - The mouth of an underground adit or tunnel.

Precious Metal - A general term for gold, silver or any of the minerals of the platinum group.

Pregnant Solution - Solutions derived from the leaching process which contain dissolved metals.

Preservation - A visual quality objective that provides for ecological change only.

Productivity - In reference to vegetation, productivity is the measure of live and dead accumulated plant materials.

Project Alternatives - Alternatives to the proposed Project developed through the NEPA process.

Public Scoping - Scoping is the process for determining the scope of issues and concerns to be addressed and for identifying the significant issues related to a proposed action. (40 CFR 1501.7).

Raise - Vertical or inclined opening that connects underground mine workings from level to level. Raises are designed to serve as an ore pass, a manway, or for ventilation, and are driven upwards.

Raptor - A bird of prey (e.g., eagles, hawks, falcons, and owls).

Recontouring - Restoration of the natural topographic contours by reclamation measures, particularly in reference to roads.

Record of Decision (ROD) - A decision document for an Environmental Impact Statement or Supplemental EIS that publicly and officially discloses the responsible official's decision regarding the actions proposed in the Environmental Impact Statement and their implementation.

Refractory - Said of an ore from which it is difficult to recover the valuable constituents.

Reserves - Identified resources of mineral-bearing rock from which the mineral can be extracted profitably with existing technology and under present economic conditions.

Resources (geologic) - Reserves plus all other mineral deposits that may eventually become available - either known deposits that are not recoverable at present, or unknown deposits, that may be inferred to exist but have not yet been discovered.

Retention - A visual quality objective which, generally means man's activities should not be evident to the casual forest visitor.

Riparian - Situated on or pertaining to the bank of a river, stream, or other body of water. Riparian is normally used to refer to plants of all types that grow along streams, rivers, or at spring and seep sites.

Runoff - That part of precipitation that appears in surface streams; Precipitation that is not retained on the site where it falls and is not absorbed by the soil.

Scoping - Procedures by which agencies determine the extent of analysis necessary for a proposed action, (i.e., the range of actions, alternatives, and impacts to be addressed; identification of significant issues related to a proposed action; and the depth of environmental analysis, data, and task assignments needed).

Sediment Load - The amount of sediment (sand, silt, and fine particles) carried by a stream or river.

Sediment - Material suspended in or settling to the bottom of a liquid. Sediment input comes from natural sources, such as soil erosion, rock weathering, or anthropogenic sources, such as forest or agricultural practices, or construction activities.

Seismicity - The likelihood of an area being subject to earthquakes; the phenomenon of earth movements.

Shaft - An underground vertical passage sunk into an orebody or near an orebody, generally on the footwall side.

Significant - As used in NEPA determination of significance requires consideration of both context and intensity. Context means that the significance of an action must be analyzed in several contexts such as society as a whole, and the affected region, interests, and locality. Intensity refers to the severity of impacts (40 CFR 1508.27).

Silification, Silicified - A type of alteration in which the original minerals in the rock are replaced by silica.

Stopes - An underground excavation formed by the extraction of ore.

Sub-grade - Ore from which minerals cannot be extracted profitably with existing technology and under present economic conditions.

Threatened Species - Any species of plant or animal which is likely to become endangered within the foreseeable future throughout all or a significant portion of its range.

Total Dissolved Solids (TDS) - Total amount of dissolved material, organic or inorganic, contained in a sample of water.

Total Suspended Particulates (TSP) - Particulates less than 100 microns in diameter suspended in a liquid sample. (Stokes equivalent diameter).

Total Suspended Soils (TSS) - Amount of undissolved particles suspended in liquid.

Tunnel - A relatively level underground passage through a mountain with two openings.

Visual Quality Objective (VQO) - A desired level of excellence based on physical and sociological characteristics of an area. Refers to degree of acceptable alteration of the characteristic landscape.

Visual Resource - The composite of basic terrain, geologic features, water features, vegetation patterns, and land use effects that typify a land unit and influence the visual appeal the unit may have for viewers.

Waste Dump - Location and/or destination of waste, spoil, or overburden material removed during the mining operation to expose the orebody, but not including the marketable mineral, subsoil and topsoil.

Waste Rock - Non-ore rock that is extracted to gain access to ore. It contains no ore metals or ore metals at levels below the economic cutoff value, and must be removed to recover the ore.

Waters of the United States - A jurisdictional term from Section 404 of the Clean Water Act referring to waterbodies such as lakes, rivers, streams (including intermittent streams), mudflats, sandflats, wetlands, sloughs, prairie potholes, wet meadows, playa lakes, or

natural ponds, the use, degradation, or destruction of which could affect interstate or foreign commerce.

Watershed - The geographic region from which water drains into a particular stream, river or body of water. A watershed includes hills, lowlands, and the body of water into which the land drains. Watershed boundaries are defined by the ridges or divides separating watersheds.

Wetlands - Areas that are inundated by surface or groundwater with a frequency sufficient to support and under normal circumstances does or would support a prevalence of vegetation or aquatic life that requires saturated or seasonally saturated soil conditions for growth and reproduction.

Wilderness - Land designated by Congress as a component of the National Wilderness Preservation System.

Winze - A large blind shaft that is sunk underground.

INDEX

Appendices

Appendix A

Overview of the Waste Rock Characterization and Handling Plan

OVERVIEW OF THE WASTE ROCK CHARACTERIZATION AND HANDLING PLAN

IMC has developed a waste rock characterization and handling program as part of the Plan of Operations for the proposed Mine Expansion Project. The purpose of the plan is to minimize the potential for adverse effects to waters of the State by identifying and selectively handling those portions of the waste rock that have the potential to generate acid.

Waste Characterization:

The primary objective of the waste rock characterization is to identify materials having a moderate/high potential risk of generating acid. Verification of waste rock classified as having a low risk of forming acid is also a component of the characterization program.

Characterization will be accomplished through a combination of visual identification of known acid-forming rock types in the field and geochemical testing. Geochemical characterization of waste will utilize the Net Acid Generating (NAG) procedure, with periodic checks using static testing methods. Low risk zones will be evaluated under a verification program that involves sampling and analysis on a less frequent basis than characterization sampling and analysis.

Previous geochemical studies utilized static, kinetic and NAG test methods to determine threshold values for delineating potentially acid producing waste. The kinetic test results showed strong correlation with the results of the NAG test. The NAG is a rapid procedure that can be routinely used to test a large number of samples per day. It involves the addition of hydrogen peroxide to a sample of waste rock and measurement of solution pH after 24 hours. The acidity of the final pH after complete reaction is a direct measure of the net acid generated by the sample. Threshold values for delineating potentially acid producing and non-acid producing waste by this analysis method were derived (Schafer, 1994). These threshold values will be used during delineation of acid-forming material using the NAG procedure.

The results from the geochemical testing will be used to develop a waste rock model for the individual mine areas. This model will be used to help predict the occurrence of zones with moderate/high risk of forming acid. The model will also be used to assist in determining minimum sampling frequencies for characterization sampling.

Handling Plan:

The primary objective of the waste rock handling plan is to prevent acid-forming materials from degrading the waters of the State. This will be accomplished with one or more of the following methods, used alone or in combination: 1) selective handling and isolation of acid-forming waste rock, 2) capping, contouring or drainage control to reduce infiltration, and 3) blending and dilution of acid-generating materials.

The selective handling operations will be designed to isolate acid forming materials from continual exposure to air and water through a variety of methods. The selective handling technique to be used in a given area will depend on several factors, including but not limited to: the geochemical character of the material that is mined; the volume of material that is characterized as acid-forming; the availability of fine textured materials; dump sequencing and pit phasing; mining methods; and other factors.

Materials that are determined through the characterization program to be acid-forming will to the extent practicable be isolated in the interior of the dumps. Constructing dumps in lifts with acid-forming materials dumped at an intermediate elevation is one effective method of creating isolated zones. Zones containing acid-forming materials will be covered with neutral materials that are compacted by heavy equipment during normal dump development operations. The fines that tend to remain near the top of the waste rock dumps will facilitate sealing of the surface of each lift. The application of growth medium and establishment of vegetation on the dump surfaces will further limit infiltration. The goal of these activities will be to reduce infiltration by surface water into the zone of acid-generating waste. Surface water drainage across the tops of the dump will be controlled to minimize infiltration into the zones within the dumps that contain acid-forming materials.

In areas where acid-forming rock constitutes a significant portion of the dump material, the dump will be situated and designed to reduce infiltration to the extent possible. The portions of the dumps containing acid-generating materials will be developed in an area that is not in direct contact with the natural topography or the dump foundation and is well outside of a drainage channel. Where operationally feasible, a drainage layer composed of neutral material will be pre-constructed along the base of the dump at the contact with natural topography. Areas of the dumps that contain acid-forming material will be capped with fine material that segregates during dumping and is compacted during heavy equipment operation.

Dilution and mixing will be used where small, isolated zones of acid generating materials are encountered and an adequate volume of suitable materials are available for blending. Blended material will be situated in the interior of the dump to the extent possible. Construction of a drainage layer at the foundation of the dump, capping with fine material compacted during operations, and armoring with a coarse and durable armor layer will create an isolated zone that is surrounded by non-acid forming rock.

Appendix B

Jerritt Canyon Mine Expansion Surface Water Monitoring Program

Appendix

[illegible] Cannon Mine [illegible] Water Monitoring Program

JERRITT CANYON MINE EXPANSION

SURFACE WATER MONITORING PROGRAM

INTRODUCTION

This document describes the surface water monitoring program to be implemented under the Jerritt Canyon Mine Expansion. Since the mining activities to be implemented in the Saval/Steer, New Deep and Burns Basin mine areas would have the potential to affect Jerritt Creek and Burns Creek, this program is specific to these two watersheds. In addition, springs that are located downgradient of the project area will also be included in the monitoring program. Surface water monitoring of the existing mining operations at Jerritt Canyon is conducted under plans of operation specific to those mining activities.

Surface water quality and quantity will be monitored at established surface water monitoring stations in Jerritt Canyon (JC-2) and Burns Creek (BC-1, BC-2, BC-3) as well as Charlie Van Norman Spring (CVS), Niagra Spring (Jim Wright Spring) (JWS) and Van Norman Spring (VNS). Surface water quantity will be measured at a site labeled JC-3 that will be established on Jerritt Creek near the Forest Service (USFS) boundary.

This program represents a refinement of past efforts at the monitoring stations listed above. Refinement of the monitoring program was based upon review and evaluation of the existing water quality and quantity information base. Parameters that would indicate a change in baseline water quality and quantity have been added to the parameter list. Changes in stream channel morphology will be monitored by periodic pebble counts and channel cross-sections at select locations.

PURPOSE

The purpose of this Surface Water Quality Monitoring plan is two-fold. The first is to satisfy the requirement to monitor surface water quality under the Water Pollution Control permit issued by the Nevada Division of Environmental Protection (NDEP). The second is to provide the U.S. Forest Service with water quality data to be used to evaluate the effect of mining on water resources.

STATE OF NEVADA

NDEP has the authority for the regulatory administration and enforcement of water quality standards under the Clean Water Act. State compliance monitoring will involve a spatial and temporal water sampling program which will evaluate the water quality in relation to state standards NAC 445.13976, NAC 445.1339, and NAC 445.118. The water data will be submitted to the state for evaluation according to state permit.

U.S. FOREST SERVICE

The operator shall comply with applicable Federal and State water quality standards (36 CFR 228.8(b)). The intent of this monitoring is to allow the US Forest Service and IMC to evaluate the effects of the mining operation on water resources. The Forest Service will use the results of the surface water monitoring plan to evaluate any water quality trends and the effectiveness of management practices and mitigation measures, such as erosion and sediment control measures and the waste rock handling plan.

BACKGROUND

Surface and spring water quality monitoring activities in the study area were initiated during baseline analyses conducted in 1979 for the original Jerritt Canyon Project EIS (USDA Forest Service, 1980). Since then, sample site locations, analytical parameters and monitoring protocol associated with the existing program were established in consultation with the USFS. Monitoring activities were initiated at the following stations on the cited dates: JC, July 1981; JC-2, March 1992; BC-3, June 1987; BC-1 and BC-2, June 1988; Niagara Spring (JWS), July 1981; Charles Van Norman Spring (CVS), December 1988; and Van Norman Spring (VNS), January 1983. Station JC was deleted from the program in 1992 when station JC-2 was established.

DISCUSSION

Sampling Frequency: Quarterly surface water quality and quantity sampling will be conducted at monitoring sites JC-2, BC-1, BC-2 and BC-3 (Map I). Efforts will be made to sample these stations once during each of the four seasons. This is intended to allow sampling of high, low and intermediate flows. Stations CVS, JWS and VNS will be sampled on a monthly basis when access permits (Map I).

Event-based Sampling: A single-stage sediment sampler will continue to be used to collect event-based samples at station JC-2. Due to access constraints to this site during and after storm events and concerns about the effectiveness of this measuring method, the merits of continuing the event-based sampling will be evaluated. A staff gage is positioned near the sediment sampler to provide a measure of flow volume. The magnitude of the precipitation event being sampled was determined by IMC and the USFS and is presently established at the estimated 1.5 year storm.

Pebble Counts: A pebble count analysis and a channel cross section measurement will be performed at a designated channel location near sample stations JC-2 and BC-3 every three years. This monitoring interval is the minimum time frame which has been suggested in order to detect changes in channel morphology. These field analyses will be undertaken in an attempt to quantify changes in stream channel morphology that indicate downcutting, aggravation, changes in bed load volumes, or other effects to stream channel morphology. The pebble count locations will be established by USFS staff in consultation with IMC personnel. The information collected from these field measurements will be reviewed by the USFS and IMC periodically to determine if the information suggests the need to review

management practices. Pebble count analyses procedures will be adjusted or eliminated based on analysis and evaluation of the information that is obtained.

Flow Measurements: Flows at BC-3, CVS, VNS and JWS are currently measured with a Parshall flume, stilling well and Stevens Gage. Flow measurements will be taken quarterly at BC-1 and BC-2 and monthly at BC-3 and JC-3. In order to improve accuracy these flows will be taken using a hand-held flow meter. A new location for BC-3 is currently being evaluated.

Hand-held flow instruments may be replaced in the future by equivalent technology. All flow measuring devices will be approved in cooperation with the USFS prior to installation. The manual flow measurements taken at BC-3 will be used to calibrate the permanent flow monitoring station at BC-3.

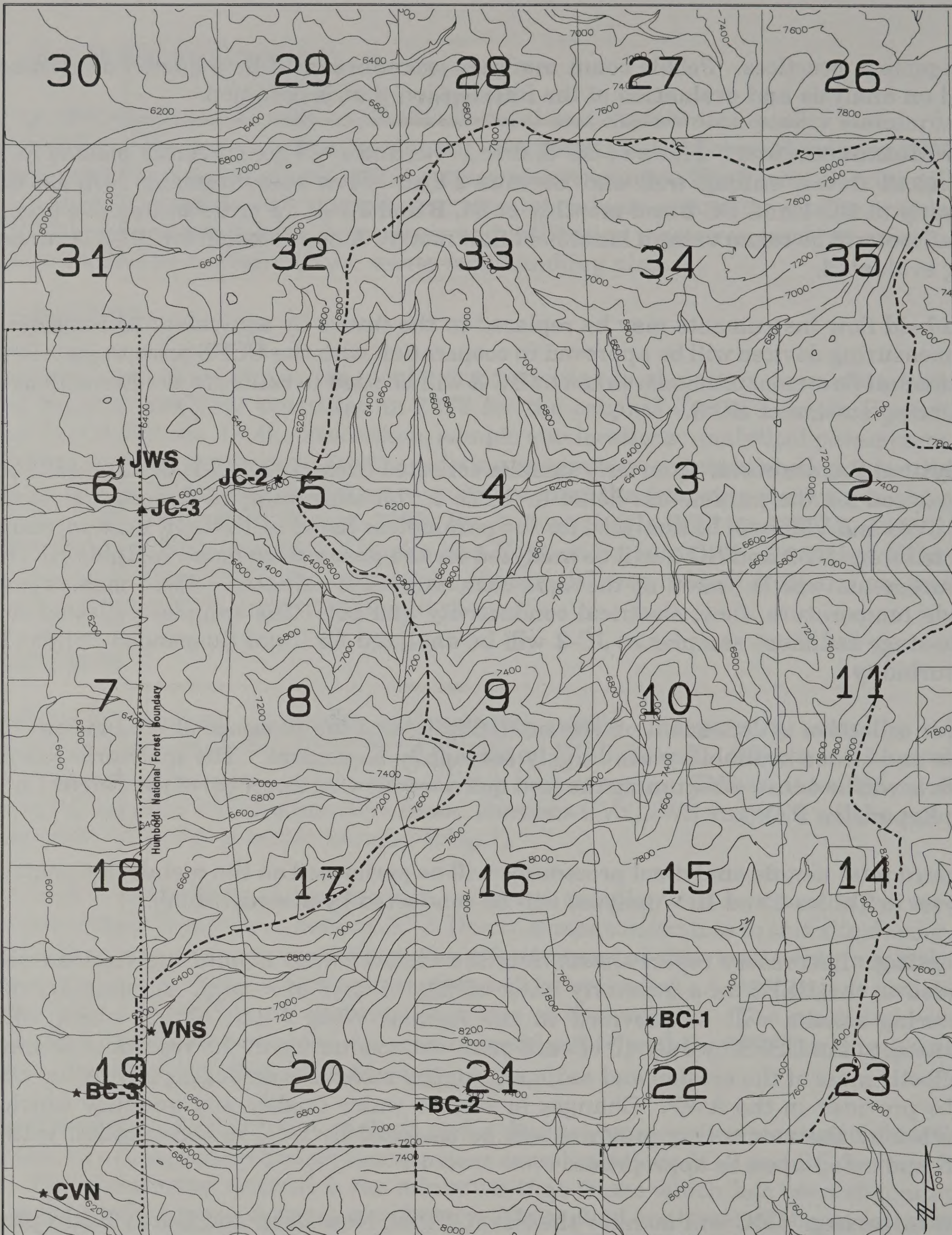
Analytical Parameters: Quarterly samples collected from JC-2, BC-1, BC-2 and BC-3 will be analyzed for the parameters listed in Table I. Monthly samples collected at stations CVS, JWS and VNS will be analyzed for the parameters listed in Table II. Annual samples collected from JC-2 and BC-3 will be analyzed for the parameters listed in Table III. Field measurements will be taken at the time each sample is collected. Field measurements include temperature, flow, electrical conductivity and pH. The samples collected in the single-stage sediment sampler at JC-2 will be analyzed for Total Suspended Solids (TSS) and turbidity.

Sample collection is dependent on site accessibility and the presence of streamflow. Both access and water availability are largely seasonally dependent. The quarterly sampling schedule will be enacted beginning the first quarter following approval of the Jerritt Canyon Mine Expansion P.O.O.

Standard total metals analytical procedures will be performed on the metals designated for analysis in Tables I and II. Analyses will be conducted by a certified lab.

Reporting: Laboratory report sheets from the surface water monitoring stations will be provided to the USFS on a quarterly basis within 45 days of receipt. A summary of the monitoring results will be provided in the Annual Work Plan (AWP), which will be submitted to the USFS by July 15 of each year. An evaluation of the results to determine the effectiveness of the erosion and sediment control measures and other mitigation efforts will be provided in the AWP. Changes in surface water quality and quantity which are identified by the monitoring program will be assessed by IMC in consultation with the USFS and acted upon as appropriate.

Pit Monitoring: IMC will monitor the Saval, Steer, New Deep and Burns Basin pits for two years after the exhaustion of the mineral deposits to determine if water will be impounded within the pits. If the pits are not freely draining, the USFS, IMC, and NDEP will evaluate the situation to determine if the pits shall be allowed to retain water or if measures must be taken to provide drainage. If water is allowed to remain in the pit, IMC will evaluate the expected quality of the water to ensure that it meets State guidelines.



SURFACE WATER MONITORING STATIONS

★ Flows and Quality Samples
▲ Flow only

–·–·–· Project Area Boundary
·········· Humboldt National Forest Boundary

SCW : 3/17/93

Jerritt Canyon Mine Expansion Project
Surface Water Monitoring Locations

Scale in Miles
0 1/8 1/4 1/2 1
CONTOUR INTERVAL 200 FEET

Map 1

Jerritt Canyon Mine Expansion
Surface Water Monitoring Plan

Table I
Quarterly Sampling Parameters
Stations JC-2, BC-1, BC-2, BC-3

Laboratory Parameters

As	SO4	Elect. Conduct.
Fe	HCO3	Total Alkalinity
Al	CO3	Acidity
Zn	NO3	TDS
Ca	pH	TSS
Mg	Total P	Turbidity
Cl	Total N	

Field Parameters

Temperature		pH
Elect. Conduct.		Flow

Table II
Monthly Spring Sampling Parameters
Stations JWS, VNS, CVS

Laboratory Parameters

As	TDS	Elect. Conduct.
Fe	TSS	Total Alkalinity
pH		

Field Parameters

Temperature		pH
Elect. Conduct.		Flow

Table III
Annual Sampling Parameters
Stations JC-2 and BC-3

Laboratory Parameters

K	Hg	Cr
Ni	Se	Ba
Pb	Cd	Ag

Appendix C

Wetland Mitigation Plan

Appendix C Contents:

- Approval letter from Robert W. Junell, Chief, Nevada/Sierra Regulatory Office, U.S. Army Corps of Engineers (March 3, 1994)
- Public Notice, from the U.S. Army Corps of Engineers No. 199300140
- Revised Mitigation Plan for the Jerritt Canyon Project Area

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA 95814-2922

REPLY TO
ATTENTION OF

March 3, 1994

Regulatory Section (199300140) (Mitigation Approval)

Robert W. Micsak
Vice President
Independence Mining Company
5251 DTC Parkway, Suite 700
Englewood, Colorado 80111

Dear Mr. Micsak:

This letter serves as clarification of our 24 November 1993 letter concerning the mitigation plan developed for project # 199200586. As noted in the 24 November 1993 letter, the mitigation plan submitted by you, with amendments, has been approved for project # 199200586. In addition, the Corps approves the use of this mitigation plan to mitigate for any impacts that will occur under project # 199300140 (Jerritt Canyon Expansion). It must be understood however, that the ratio of impacts to mitigation will be set by the Corps and the ratio, or number of acres to be used from this plan, has not been set for project # 199300140, but will be established in the special conditions to any permit issued under project # 199300140.

If you have any questions, please write to Cpt. Rodney W. Gettig, Room 1444 at the letterhead address, or telephone (916) 557-5251.

Sincerely,

Bob Junell

Robert W. Junell, Chief
Nevada/Sierra Regulatory Office

US Army Corps
of Engineers

Sacramento District
1325 J Street
Sacramento, CA 95814-2922

Public Notice

Public Notice No. 199300140

Date: 14 January 1994

In Reply Refer to the above Public Notice No.

Comments Due: 14 February 1994

TO WHOM IT MAY CONCERN:

SUBJECT: Application for a Department of the Army permit under authority of Section 404 of the Clean Water Act to place fill material within various headwaters of tributaries to the South Fork of the Owyhee River as shown in the attached drawings.

APPLICANT: Independence Mining Company Inc.
5251 DTC Parkway, Suite 700
Englewood, Colorado 80111

LOCATION: The proposed mine development activities are located in the Independence Mountain Range within the Humboldt National Forest approximately fifty miles northwest of Elko, Nevada.

PURPOSE: The purpose of the Jerritt Canyon Mine Expansion Project is to allow the continued and uninterrupted supply of gold bearing ore to the existing milling operations in an economically feasible manner. The proposed Saval/Steer, New Deep and Burns Basin mining expansion areas would replace gold ore reserves that have been exhausted over the past twelve years at the existing Jerritt Canyon mining operations.

PROJECT DESCRIPTION: The expansion of Independence's mining operations within the Jerritt Canyon Project Area involves the discharge of fill material into wetlands or waters of the United States for the following activities: waste rock dumps, haul road crossings, sediment control structures, and support facilities. The total impacted jurisdictional area for the proposed mine expansion is 3.40 acres to wetlands and 5.90 acres to waters of the United States for a total impact of 9.30 acres. These impacts are based on the applicant's proposed action. This would be in addition to previously authorized impacts in the Jerritt Canyon mine area of 3.57 acres to wetlands and 4.12 acres to waters of the United States (a total impact, previously authorized, of 7.69 acres) leading to a cumulative total impact (previous authorized and proposed) of 16.99 acres. The applicant proposes to mitigate the projected loss of all wetlands resources through the creation of new wetlands habitat. A mitigation plan, previously approved by the Corps, is in place and initial activities for habitat creation have been completed.

AREA DESCRIPTION: The proposed mine development activities are located on the western slope of the Independence Mountain Range. The Independence Mountains are flanked by the Independence Valley

to the west and the North Fork Valley to the east. Topography within the project area ranges from moderate slopes to sheer cliffs, with deeply dissected canyons, rolling ridges and shallow draws. Foothills and valleys along the west margins of the range in elevation from 6,100 feet to 8,500 feet.

Vegetation: Great Basin sagebrush/grasslands are the dominant community type followed by mature aspen and north-facing mountain brush. Mature aspen typically occur on north facing slopes in the drainage bottoms. North-facing mountain brush community type is normally found as discontinuous patches located on steep slopes with a northerly aspect.

Climate: Average precipitation within the project area varies from about 12 inches at the 6,000 foot level to more than 26 inches above the 8,000 foot level, the majority of which falls as snow during the winter. The climate is typical of the Great Basin region with rather severe winters and mild to hot summers. Some snow persists in the higher elevations until July and additional precipitation in the summer falls during thunderstorms. Most of the precipitation supplied to the project area is lost through evapotranspiration. Estimates by the USGS suggest that over 80 percent of the precipitation in this vicinity is lost through evapotranspiration near its point of deposition. It is either lost immediately upon falling or later in the year following seasonal storage as snow or soil moisture. Of the approximately 20 percent of total precipitation that becomes runoff or groundwater, nearly all is ultimately lost through evapotranspiration within the river valleys.

ADDITIONAL INFORMATION:

Environmental Impact Statement: The United States Forest Service (USFS), Humboldt National Forest has prepared a Draft Environmental Impact Statement (DEIS) to evaluate the potential direct, indirect and cumulative effects of the proposed project. The DEIS evaluates, in detail, the impacts of seven alternatives including the applicant's proposed action. The DEIS was released in December 1993, and the close of the public comment period on the DEIS is 18 January 1994. Included in the alternative analysis is an evaluation of impacts to wetlands and waters of the United States. The USFS's final decision on which alternative to choose will be based on, among other factors, total impacts to wetlands. The total impacts described in this Public Notice are based on the applicant's proposed alternative. If another alternative is chosen as part of the Record of Decision (ROD) issued with the Final EIS, the Corps will make a decision whether or not to issue an amendment to this Public

Notice to address any changes in effected acreages. Changes in impacts of less than one acre will most likely not be announced prior to a permit decision being made. The DEIS is available for public review at the Humboldt National Forest, Mountain City Ranger District, Mountain City, NV; the offices of the Independence Mining Company, Inc; or at the Corps office, 1325 J Street (Room 1444), Sacramento, CA.

Mitigation Plan: As mentioned above, a Corp's approved mitigation plan is in place and the initial activities for the creation of the mitigation site have been completed. The mitigation site is located along the Stump Creek drainage on the east side of the Independence Mountain Range, and encompasses an area of approximately 20 acres. This site was developed to mitigate for existing and approved wetlands impacts, as a bank for the proposed impacts under this action and for unforeseeable future impacts. Currently Independence has set aside 7.14 acres of this site as mitigation for existing impacts to wetlands.

Cultural Resources: There are no sites identified as significant or unevaluated that would fall within the proposed disturbance or within a 300 foot buffer around the proposed disturbance. Initial consultations with descendants of the Tosawihi, the native people who historically used the area, indicate there would be no direct of indirect impacts on Native American traditional sacred areas under any of the alternatives.

Endangered, Threatened or Candidate Species: Bald Eagles may occasionally migrate through the project annually. Peregrine falcons rarely pass through the area. Impacts to these endangered species would be negligible. There would be no additional impact to the only threatened species in the vicinity, the Lahontan cutthroat trout. Decreased flows and short term increases in sedimentation could have some adverse impacts for potential red band trout (a candidate species) habitat in Burns Creek. No other candidate species are anticipated to be significantly effected.

The District Engineer has made these determinations based on information provided by the applicant, the Draft Environmental Impact Statement, and on the Corps' preliminary investigation.

Interested parties are invited to submit written comments on or before 11 February 1994. Any person may request, in writing, within the comment period specified in this notice that a public hearing be held to consider this application. Requests for public hearings shall state, with particularity, the reasons for holding a public hearing.

The decision whether to issue a permit will be based on an evaluation of the probable impacts including cumulative impacts of the proposed activity on the public interest. That decision will reflect the national concern for both protection and utilization of important resources. The benefit which reasonably may be expected to accrue from the proposal must be balanced against its reasonably foreseeable detriments. All factors which may be relevant to the proposal will be considered including the cumulative effects thereof; among those are conservation, economics, aesthetics, general environmental concerns, wetlands, cultural values, fish and wildlife values, flood hazards, flood plain values, land use, navigation, shoreline erosion and accretion, recreation, water supply and conservation, water quality, energy needs, safety, food and fiber production, mineral needs, consideration of property ownership, and in general, the needs and welfare of the people.

For activities involving 404 discharges, a permit will be denied if the discharge does not comply with the Environmental Protection Agency's 404(b)(1) guidelines. Subject to the preceding sentence and any other applicable guidelines or criteria, a permit will be granted unless the District Engineer determines it would be contrary to the public interest.

The Corps of Engineers is soliciting comments from the public; Federal, state, and local agencies and officials; Indian Tribes; and other interested parties in order to consider and evaluate the impacts of this proposed activity. Any comments received will be considered by the Corps of Engineers to determine whether to issue, modify, condition, or deny a permit for this proposal. To make this decision, comments are used to assess impacts on endangered species, historic properties, water quality, general environmental effects, and the other public interest factors listed above. Comments may be used in the preparation of an Environmental Assessment and/or an Environmental Impact Statement pursuant to the National Environmental Policy Act. Comments are also used to determine the need for a public hearing and to determine the overall public interest of the proposed activity.

If additional information is required, please contact ,, telephone or Cpt. Rodney W. Gettig, at the letterhead address, telephone (916)557-5251.

John N. Reese
Colonel, Corps of Engineers
District Engineer

Enclosures: Drawing(s)

Exhibit 1. SITE LOCATION MAP

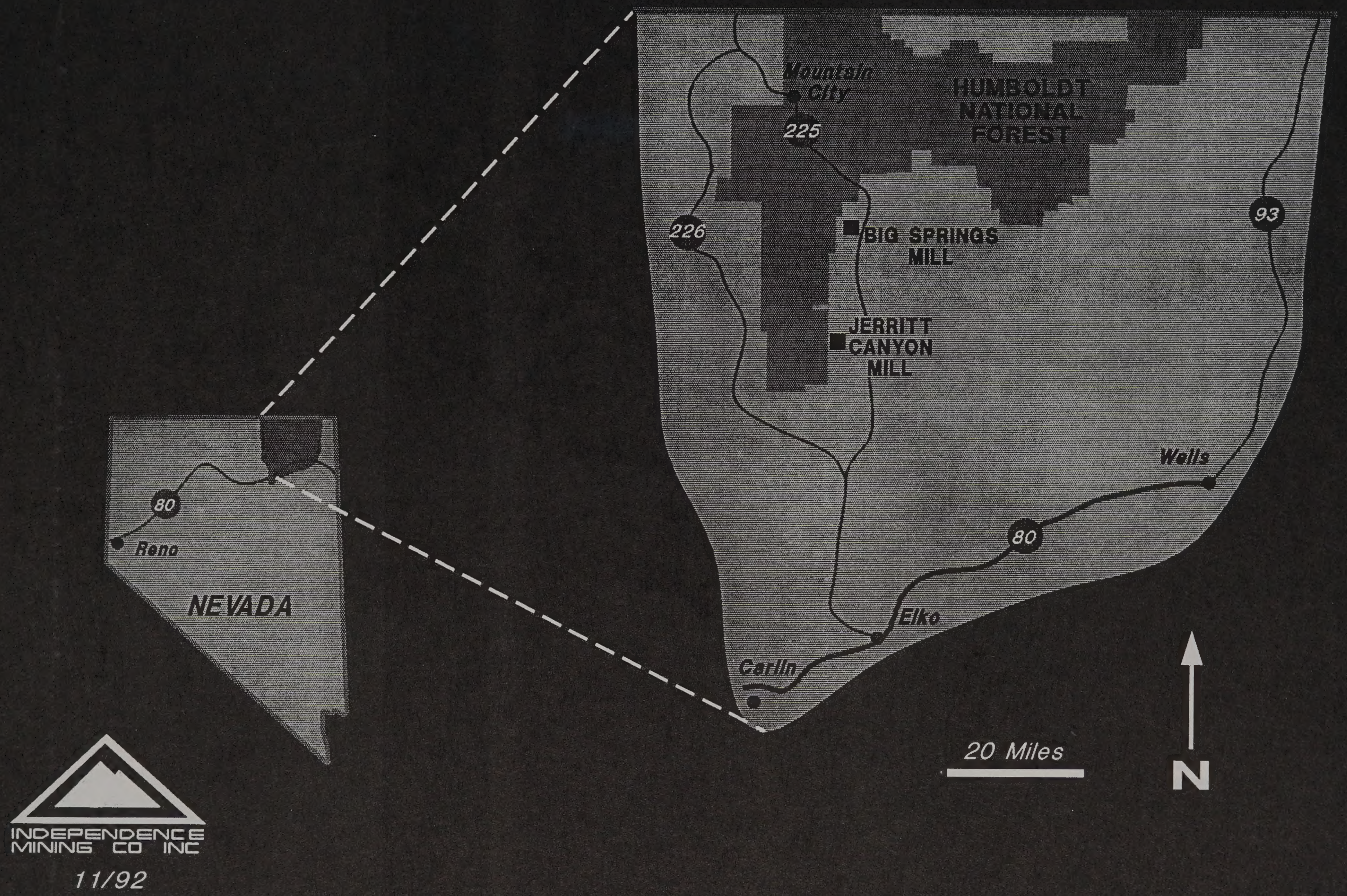
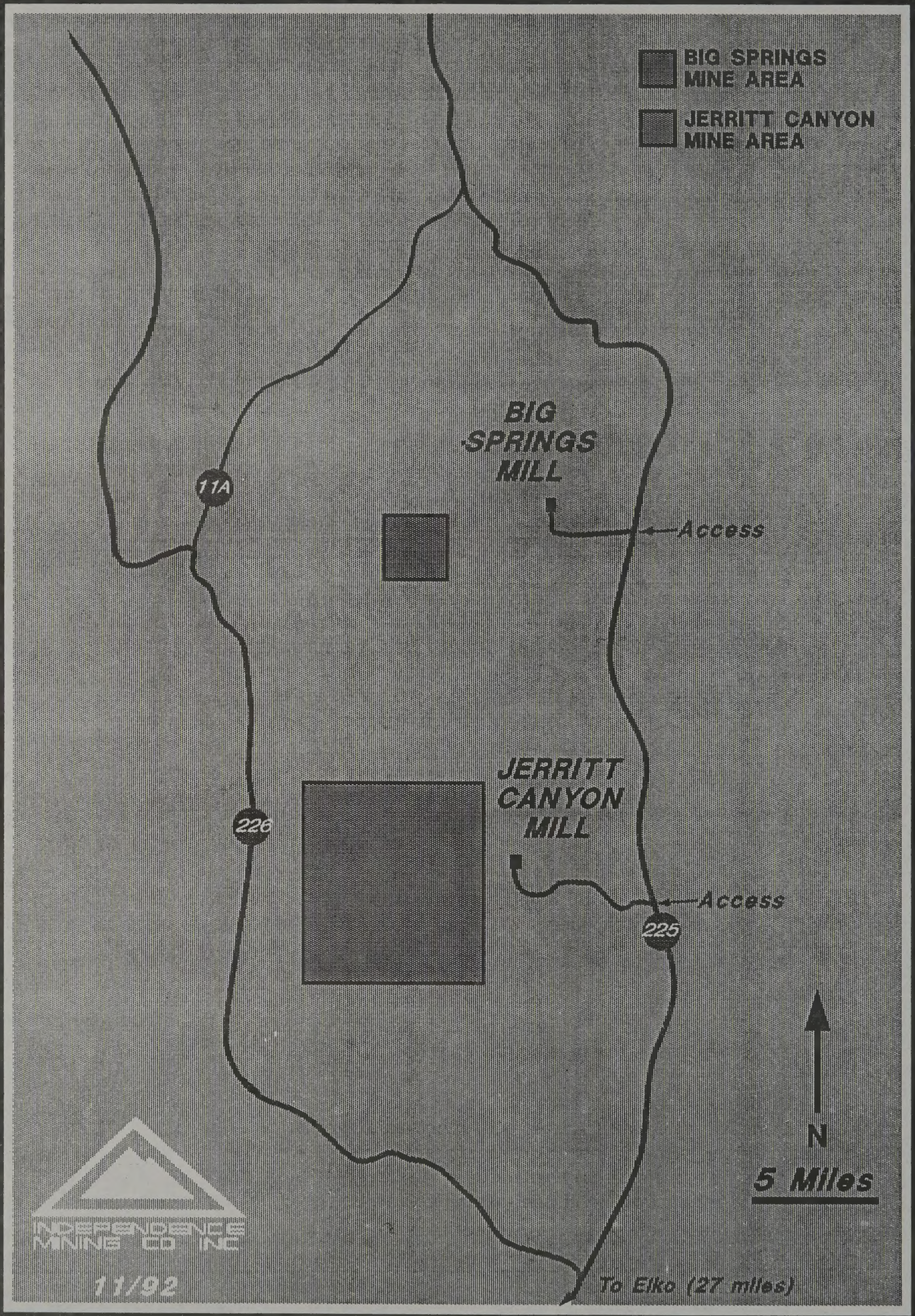
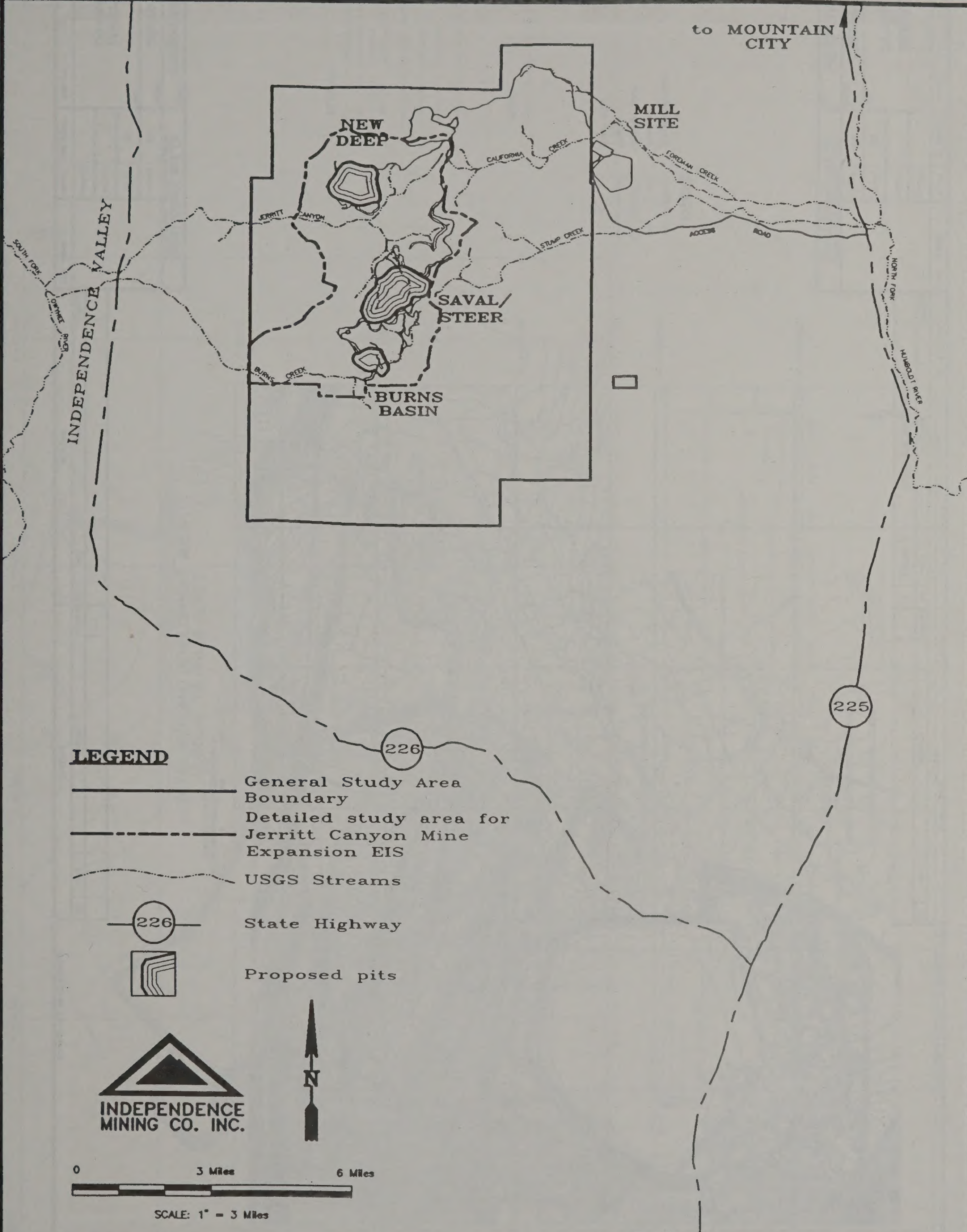
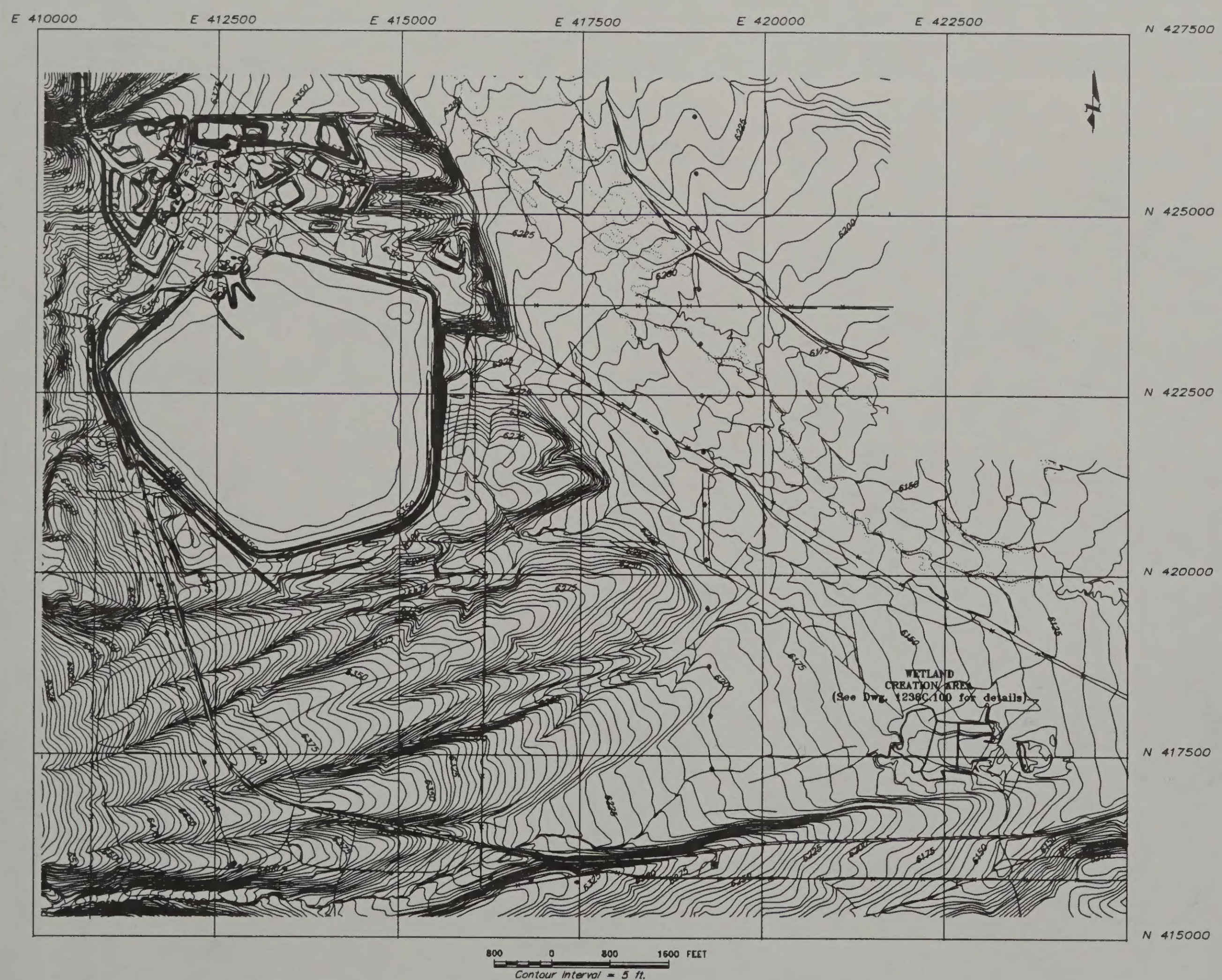


Exhibit 2. SITE LOCATION MAP



INDEPENDENCE MINING COMPANY, INC.
JERRITT CANYON MINE EXPANSION PROJECT
LOCATION MAP
MAP 1





LEGEND

6350	Existing Contours
	Drainage
	Existing Roads
	Fence
	Power Lines

REV.	DATE	DESCRIPTION	APPROVED	REV.	DATE	DESCRIPTION	APPROVED
REVISIONS				REVISIONS			

Knight Piésold and Co.
CONSULTING ENGINEERS AND ENVIRONMENTAL SCIENTISTS

DESIGNED	KLL
DRAWN	PLC
CHECKED	
APPROVED	
DATE 7/20/98	SCALE AS SHOWN

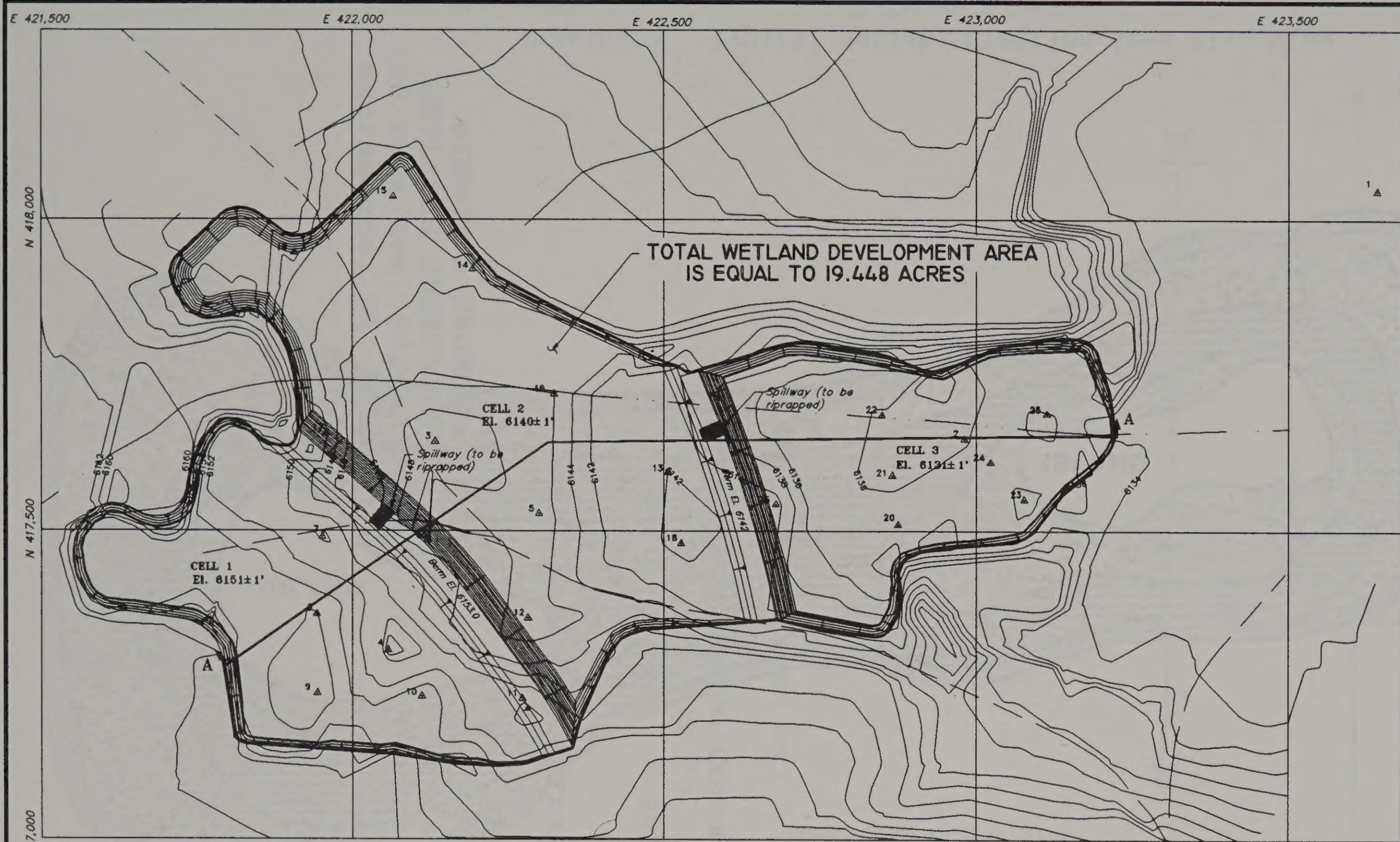
CLIENT INDEPENDENCE MINING CO.

PROJECT JERRITT CANYON

TITLE H-PIT WETLANDS OVERALL SITE PLAN

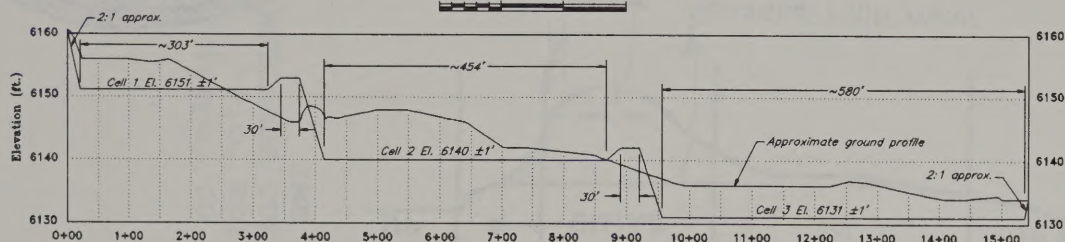
DWG. NO. 1 REV.

1=800 AUTOCAD FILE NAME: 1236M22A



PLAN

100 0 100 200 FEET



SECTION A - A

Horizontal: 100 0 100 200 FEET

Vertical: 10 0 10 20 FEET

LEGEND:

- Existing roads
- Ephemeral streams
- Contours
- 21 △ Soils test pit
- Wetlands boundary
- 10:1 slope
- 3:1 slope
- Cut slope @ 2:1 approximately

NOTES:

Existing Contour Interval = 2 ft.

REV.	DATE	DESCRIPTION	APPROVED
0	10/5/93	ISSUED FOR CONSTRUCTION	

REVISIONS

Knight Piésold and Co.
CONSULTING ENGINEERS AND ENVIRONMENTAL SCIENTISTS

DESIGNED	LJS
DRAWN	RLD
CHECKED	
APPROVED	
DATE	7/29/93
SCALE	AS SHOWN

CLIENT: INDEPENDENCE MINING CO.

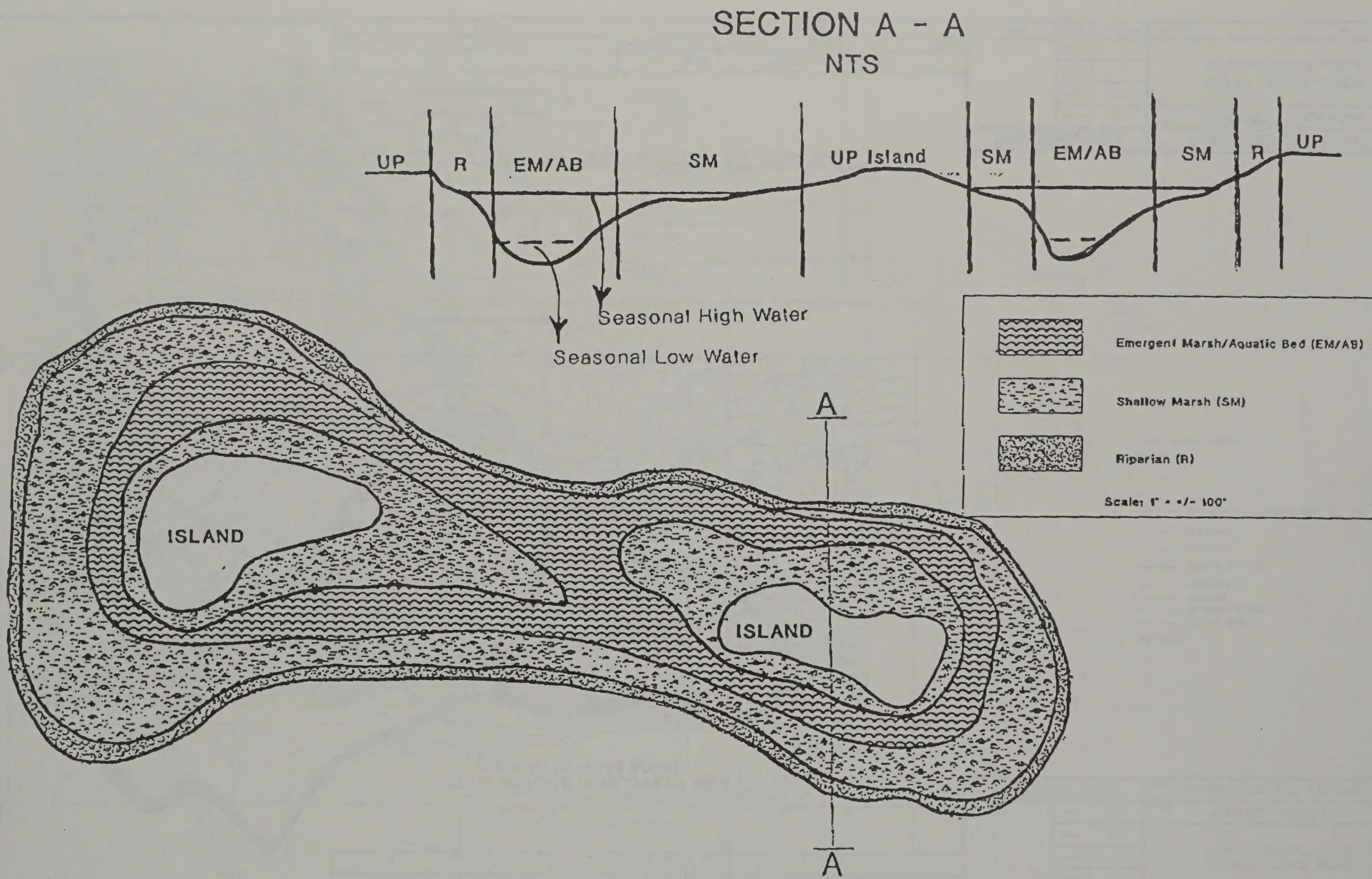
PROJECT: JERRITT CANYON

TITLE: H-PIT WETLANDS DEVELOPMENT AREA

DWG. NO. 1 REV.

1-100

AUTOCAD FILE NAME: 1238M238



Drawing 3: Typical Wetland Creation Area Plan View
& Cross-Section

INDEPENDENCE MINING COMPANY INC.

REVISED MITIGATION PLAN FOR THE JERRITT CANYON PROJECT AREA ELKO COUNTY, NEVADA

Prepared By:

INDEPENDENCE MINING COMPANY INC.
HC 31 BOX 78
Elko, Nevada 89801

With Assistance From:

GIBSON & SKORDAL
WETLANDS CONSULTANTS
100 Howe Ave. Suite 155
Sacramento, CA 95825

IME
WETLANDS CONSULTANTS
P.O. BOX 270
Yampa, CO 80483

INDEPENDENCE MINING COMPANY INC.
JERRITT CANYON PROJECT AREA
REVISED WETLAND MITIGATION PLAN

TABLE OF CONTENTS

INDEPENDENCE MINING COMPANY INC.
JERRITT CANYON PROJECT AREA
REVISED WETLAND MITIGATION PLAN

LIST OF TABLES

LIST OF DRAWINGS

LIST OF APPENDICES

INDEPENDENCE MINING COMPANY INC.
JERRITT CANYON PROJECT AREA
REVISED WETLAND MITIGATION PLAN

1.0 INTRODUCTION

Independence Mining Company (IMC) submitted a Pre-Discharge Notification (PDN) for the Jerritt Canyon Project Area to the United States Army Corps of Engineers (COE) on November 19, 1992. The PDN was prepared in response to the need for a permit to conduct fill related activities within "waters of the United States" in accordance with Section 404 of the Clean Water Act. The COE issued Nationwide Permit (NW26) authorization 92000586 on January 6, 1993. This NW26 authorization was contingent upon two Special Conditions set forth by the District Engineer as described below:

> ***1) No work shall be performed in the New Tailings Pond Area until coordination with the U.S. Fish and Wildlife Service (USFWS), regarding the possible impacts to the Lahontan cutthroat trout and the need to initiate formal consultation under Section 7 of the Endangered Species Act, is completed and this office has approved the work for the New Tailings Pond Area.***
>
> ***2) The mitigation plan will need to be revised to include more specific information regarding the types of plant communities that will be impacted and the number of acres that will be created of each of these plant community types.***

Coordination with the USFWS has been completed as required in Special Condition 1. A copy of the opinion letter issued by the USFWS and a map depicting the alternative selected by the United States Department of Interior, Bureau of Land Management will be submitted under separate cover.

IMC herein submits the revised mitigation plan in fulfillment of the requirements outlined in Special Condition number two of the Jerritt Canyon NW26 authorization. It should be noted that IMC will be creating an area of wetlands substantially larger than that necessary to satisfy the mitigation needs associated with this authorization. IMC intends to utilize any additional acreage of self-sustaining wetlands successfully created as credit toward future compensatory mitigation needs.

This plan describes specific mitigation goals, the proposed mitigation site and characteristics, plant community types to be created, success criteria, monitoring plan, and remedial actions to be taken should success criteria objectives not be met. Additionally, a summary of plant community types to be impacted is provided.

IMC intends to initiate the proposed compensatory mitigation activities on or about September 15, 1993. This start date is contingent upon several factors, including but not limited to: obtaining COE approval of this plan by August 31, 1993, acquiring concurrence from other interested agencies by the same date, ground conditions, equipment availability, or the development of other unforseen circumstances.

2.0 MITIGATION OBJECTIVE & SPECIFIC GOALS

The mitigation policy of both the United States Environmental Protection Agency and the COE is set forth in the "Memorandum of Agreement Between Environmental Protection Agency and the Department of Army Concerning the Determination of Mitigation Under the Clean Water Act Section 404(b)(1) Guidelines" (the Memorandum), dated November 15, 1989. The Memorandum states that compensatory mitigation is appropriate to offset unavoidable adverse impacts which remain after all appropriate and practicable measures have been taken to minimize impacts. The Memorandum indicates that there be no net loss in wetland values. It notes that, in most cases, a one-to-one replacement ratio is necessary to achieve no net loss of values. However, the ratio may be either greater or lesser than one-to-one depending on the functional value of the impacted wetland and likelihood of success of the mitigation effort.

The objective of this mitigation plan is to present a conceptual plan to compensate for wetland impacts consistent with established mitigation guidelines. IMC, to the extent practicable, will: 1) avoid impacts to wetland habitats; 2) minimize wetland impacts which are unavoidable; 3) replace all wetland habitat that is disturbed as a result of mine development activities with a mitigation ratio of at least 1:1 and up to 2:1; and, 4) create new wetland habitat with similar functional values to those which were lost.

The Jerritt Canyon PDN, described 3.57 acres of wetlands impacts which were, or will be, incurred as a result of the existing mining activities approved under the National Environmental Policy Act. IMC will therefore create 7.14 acres of self-sustaining wetlands to mitigate these impacts. This is consistent with a 2:1 mitigation ratio. Wetland

acreage created as a result of the implementation of this plan which exceeds the 7.14 acres will be "banked" for future mitigation needs.

3.0 WETLANDS IMPACTED & WETLANDS TO BE CREATED

In response to the additional information requested by the COE in the Jerritt Canyon NW26 authorization, a detailed summary of wetlands and plant community types to be disturbed is presented in this section. Since most of the wetlands have already been impacted, this summary is based on those wetlands where data was collected from the formal sample plots described in the delineation report submitted to the COE on October 16, 1992. After reviewing pre-mining infrared photographs and the delineation of impacted wetlands, we believe it is reasonable to conclude that the distribution of impacts which occurred prior to the PDN submittal are representative of those described in this summary.

The delineation report submitted to the COE identified three different types of wetlands which were found in the Jerritt Canyon Project Area: (1) riparian wetlands located adjacent to drainage bottoms; (2) springs and seeps adjacent to drainage bottoms; and (3) isolated springs and seeps. Impacts to each wetland type were calculated by evaluating the sample plot data obtained during the delineation. The sample plot data were then further evaluated to identify the specific plant community type to be disturbed. The vegetation characteristics of each sample plot were compared to the plant community descriptions contained in the <u>Riparian Community Type Classification for the Humboldt and Toiyabe National Forests, Nevada and Eastern California</u> and classified by type. Five (5) different plant community types were identified in this evaluation. The results of this evaluation are summarized in Table 1. A description of the five (5) different plant communities to be disturbed is presented below.

3.1 <u>Plant Community Types Impacted</u>

A total of 0.439 acres of the geyer willow/mesic graminoid plant community type will be disturbed. This plant community type is found within Deadmans Spring in the Winters Creek pit area and corresponds to the isolated springs and seeps wetland habitat type. The percent cover by plant species for the three formal wetland sample plots completed in this type is presented in Table 2.

The disturbance to the geyer willow/beaked sedge plant community type will be approximately 0.302 acres. This plant community type is located downstream of the existing Burns Basin waste rock dump and corresponds to the riparian wetlands located adjacent to drainage bottoms wetland habitat. The percent cover by plant species for this wetland plant community type obtained from ten formal wetland sample plots is presented in Table 3.

Approximately 0.063 acres of the false hellebore plant community type will be disturbed. This wetland plant community is located in two different mine disturbance areas. Below the Burns Basin waste rock dump, approximately 0.038 acres will be disturbed and an additional 0.025 acres will be disturbed in the vicinity of the California Mountain waste rock dump. This plant community type corresponds to the springs and seeps adjacent to drainage bottoms wetland habitat type. The percent cover associated with this wetland plant community from ten formal wetland sample plots is presented in Table 4.

The meadow barley and Baltic rush plant community types will each experience approximately 0.034 acres of disturbance. This disturbance will occur in the drainage below the Gracie Dump. The percent cover associated with the meadow barley plant community for the four wetland sample plots is presented in Table 5. The percent cover associated with the Baltic rush plant community is presented are Table 6.

The authorized impacts to wetlands habitats associated with the PDN total approximately 3.57 acres. When the plant community impacts described above are extrapolated to encompass those areas for which sample plot data could not be obtained, a reasonable summary of impacts to each plant community may be derived. The approximation of total impacts to each plant community type is presented in Table 1.

3.2 Plant Community Types To Be Created

IMC will replace those plant communities to be impacted with wetlands habitat of comparable vegetative composition and percent cover. IMC proposes to mitigate impacts to wetlands habitat and replace those plant community types lost in a manner similar to the wetlands created at IMC's Big Springs operation. Approximately 3.74 acres of wetlands habitat has been established as a result of the Big Springs mill site excavation

activities. Wetland plant communities similar to those to be impacted have established in the excavated areas. There was no prior planning to ensure the development of wetland habitat in these areas. IMC should, at a minimum, be able to create wetlands habitat similar to those at Big Springs with the implementation of this plan. Photographs of the Big Springs wetlands are contained in Appendix A.

4.0 PROPOSED MITIGATION SITE SELECTION

A number of factors have influenced the selection of a mitigation site to conduct compensatory wetlands development activities. The original mitigation plan presented in the Jerritt Canyon Project Area PDN identified twelve wetland mitigation development sites. After further evaluation of these sites, it is not possible to ensure that these areas will be avoided during future mining related activities. Additionally, wetland development activities proposed on lands administered by United States Department of Agriculture, Forest Service would likely require NEPA analysis and approval. This could delay implementation of the wetlands mitigation activities until at least the 1994 field season. The most important factor considered for wetlands creation was that adequate water to support hydrophytic plant species must be present. Other factors considered include property ownership, water rights, existing hydrological conditions, soils, and effects on grazing allotments.

Based on consideration of the factors described above, IMC proposes to conduct compensatory wetlands mitigation within a gravel quarry which is located approximately two miles southeast of the Jerritt Canyon mill facility. The gravel quarry is referred to as H-Pit. This site was originally disturbed during 1980 in connection with the construction of the Jerritt Canyon Mill and Mine access road. The lands within this area are owned and controlled by IMC.

The opportunities for wetlands development within H-Pit were presented to the COE and other interested regulatory agencies by IMC and Mr. Tom Skordal of Gibson & Skordal Wetlands Consultants on June 17, 1993. Highlighted during this presentation was the potential to create wetlands habitat in an area that is currently void of such an environment. The mitigation sites proposed in the Jerritt Canyon PDN would, if constructed, merely extend the limits of riparian and wetland habitats where these types of areas already exist. Interested regulatory agency representatives who attended the June 17th meeting discussed the merits of creating one large wetland

within H-Pit rather than the several smaller sites originally proposed in the PDN. The proposed H-Pit wetlands development area is shown in Drawing 1.

5.0 MITIGATION SITE CHARACTERISTICS

In its present configuration, the proposed H-Pit wetlands development site consists of a series of topsoil and gravel stockpiles, access roads, and exposed gravel areas. As much as 10 feet of material has been excavated from this site for use in construction projects. Big sagebrush, rubber rabbitbrush, bottlebrush squirreltail and cheatgrass brome dominate the flatter areas where there are sufficient fine grained soils to retain moisture. The majority of the site has a sparse cover of perennial vegetation and is dominated by annual grasses and forbs. A detailed summary of site characteristics is provided below.

5.1 Vegetation

Prior to the H-Pit construction activities in 1980, vegetation surveys were completed in conjunction with the original Jerritt Canyon Environmental Impact Statement. The Vegetation Technical Report for Jerritt Canyon Project, Humboldt National Forest prepared by Environmental Research & Technology (ERT) in October 1979 indicates that the entire H-Pit site was mapped as an alluvial sagebrush-grass vegetation type. According to ERT's description of this vegetation type, the dominant shrub species occurring in this area prior to disturbance were big sagebrush and black sagebrush. Sandburg bluegrass and bottlebrush squirreltail were the most frequently encountered grasses. Goldenweed was the most frequent forb. All plant species within this type were classified upland.

5.2 Soils

Examination of the mapping completed by the Soil Conservation Service (SCS) prior to any disturbance reveals that two soils units existed in the vicinity of the proposed mitigation site. Specifically, SCS soil units 223 and 456 were mapped in this area. The three soil series constituting mapping unit 223 are all classified as aridisols. Soils series comprising mapping unit 456 are aridisols, aridic agrixerolls or aridic durixerolls. All of these classifications indicate that these soils do not meet the hydric soil criteria.

IMC recently completed a subsurface investigation of soil types and profiles which exist within the proposed

wetlands development area. A total of twenty-six test pits were excavated to obtain soils data. The results of this investigation indicate that the soil strata consists of gravels, sands, silts, and clays deposited in a heterogeneous manner. Saturated soils which exhibited signs of mottling were encountered at numerous test sites at varying depths. A summary of IMC's subsurface soil investigation is contained in Appendix B.

5.3 Hydrology

IMC initiated static water level monitoring activities using the soil test pits constructed within the proposed mitigation site on April 12, 1993. Initially, four (4) test pits were monitored on a daily basis to evaluate the depth to water and to establish a baseline from which trends could be evaluated. Water level monitoring data was later obtained from each of the test sites established in conjunction with the soils investigation on a bi-weekly basis.

The results of IMC's water monitoring activities indicate that alluvial water flows may be sufficient to provide the necessary hydrology for the establishment of wetland plant communities. Water was encountered within three feet of the surface at soil test pits #3 and #4 throughout the first three weeks of monitoring. These test pits are located within the western half of the proposed mitigation site as shown in Drawing 2.

Surface water flow within the Stump Creek drainage started on April 16, 1993. Approximately 450 gpm of water was gauged at the Stump Creek drainage entry to the proposed mitigation area. This was an unanticipated, but nevertheless welcomed, result of the spring snow melt and runoff. Surface water flows had not occurred within the Stump Creek drainage for many years as a result of the drought conditions which have been experienced in this area for the past six growing seasons. The introduction of surface water flows through the proposed mitigation area dramatically changed the depths to water observed at the initial test pits. The water levels at pits #1 and #2 were elevated to within two feet of the surface. Test pit #3, located adjacent to the drainage channel, filled with water. Water level observations made at Station #4 continued to drop with respect to the observations made before the surface flow.

Water level observations were made at an additional twenty-two test pits later during the spring runoff. Static water levels ranged from zero to six feet below the surface. Because these test pits were established

after surface water began to flow into the mitigation area, it is not possible to determine the expected contribution of alluvial flow to the wetlands development project at these sites. A summary of the static water monitoring data is provided in Appendix C.

IMC believes that the proposed H-Pit wetlands creation area exhibits the potential to sustain wetlands habitat. However, with the limited hydrological data obtained during this very wet spring which was preceded by six years of drought, it is not possible to reliably determine the exact elevation at which groundwater will be encountered on a yearly basis. Because of this constraint, IMC proposes to develop the H-Pit wetland creation area in two phases to increase the likelihood for success. This two phase approach is described in the next Section.

6.0 CONCEPTUAL DESIGN & CONSTRUCTION TECHNIQUES

The contribution of surface water flow to the proposed wetlands creation area is not likely to occur on a perennial basis. In order to ensure the success of IMC's mitigation efforts, it will be necessary to excavate additional materials from the existing surface within H-Pit. The hydrological data obtained in conjunction with IMC's soils investigation indicates that there appears to be sufficient groundwater for the establishment of wetland plant communities within four to five feet of the H-Pit surface. Until this is verified, the prudent approach is to excavate the wetlands creation area to an elevation which would likely provide the required hydrology and then monitor and evaluate the site during the spring and early summer of 1994. If additional excavation were necessary to lower the elevation, IMC could then do so without having to remove valuable topsoil and other wetland creation area attributes. The Phase I construction activities will accomplish the excavation necessary for evaluation of the hydrological conditions within H-Pit. Phase II will consist of spreading topsoil and constructing nesting islands, hydrological control berms, and other attributes.

6.1 Phase I Wetlands Development Activities

IMC believes that sufficient groundwater interception will occur with the excavation of 4.5 feet of materials from the existing surface of H-Pit. Approximately twenty acres will be excavated as shown on Drawing 2. Detailed drawings will be prepared and used during the excavation. The construction site will be surveyed and stakes will be placed showing the equipment operators the extent of the excavation. Materials will be removed using dozers,

scrapers, motor graders, or loaders either alone or in combination. Excavation will begin along the west side of the wetlands creation area shown on Drawing #2. The area will be developed with a relatively flat surface maintaining a slope of no more than (-1.5%) toward the east. Test pits will be excavated at specified locations throughout the creation area to monitor the depth to water should the area not be inundated during the following spring.

Materials encountered during Phase I excavation which are suitable for future construction projects will be transported to a site away from the wetlands creation area. Soils which exhibit an ability to retain moisture will be designated for use in developing the wetlands, and segregated from coarse textured materials. The soils designated for use in developing the wetlands will be stockpiled in a location where they will be unaffected by subsequent activities so that they may be used during Phase II construction. Excavation operations will be supervised by a qualified individual who will ensure that the equipment operators properly implement the design plan.

Once the initial excavation is completed, side slopes will be blended into the adjacent topography at a minimum of a 3:1 gradient. A containment berm will be constructed along the downstream limit of the wetlands creation area to control the flow of water. Rip-rap spillways will be constructed at specified locations along the berm to enable overflow during heavy runoff events, and control erosion.

The excavated site will be evaluated during the next spring to determine if additional materials will need to be removed. The site will be deemed suitable for mitigation based upon adequate soil saturation to support wetlands plant species. Necessary adjustments to the creation area base elevation will be made prior to the commencement of Phase II construction.

6.2 Phase II Wetlands Development Activities

Following the completion of the excavation activities, the site will be prepared for the application of growth medium. The project supervisor will identify through field staking or other suitable means, the locations for the construction of nesting islands, additional control berms, and establish grade lines for the distribution of growth medium.

Nesting islands will be constructed by placing excavated upland soils at strategic locations within the wetland creation area. Islands will be constructed to an elevation above the anticipated seasonal high water levels. These islands will encourage the establishment of riparian habitat at the interface between the islands and the wetland area and increase the potential for success of nesting migratory waterfowl.

Berms will be placed at intervals to be determined during the Phase I evaluation to control the flow of water between each cell of the creation area. The control berms are expected to range from twenty-four to thirty-six inches in height and will be wide enough to provide access by vehicles. Rip-rap material will be placed along the spillways to control erosion. A typical plan view and cross-section of the wetlands creation area are shown in Drawing 3.

Soils that are exhibiting properties capable of supporting wetland plant communities salvaged during Phase I operations will be spread throughout the creation area. Additionally, emphasis will also be directed towards the salvage of wetland soil materials located in existing wetlands which have been approved for disturbance. IMC is also considering the feasibility of transporting weathered hay from nearby ranching operations or planting winter wheat to stabilize the site and function as a green manure for organic enrichment. Once the growth medium materials have been spread, the wetland creation area will be prepared for planting.

Disturbed upland areas bordering the development area will be planted using IMC's approved reclamation seed mixture. Where seeding of wetland areas is deemed necessary, suitably adapted, commercially available wetland plants including such species as reed canarygrass, meadow foxtail and tufted hairgrass will be used. Other species which are commercially available and which were routinely encountered in the wetland delineation sample plots will also be incorporated into the seed mixtures according to availability. Seeding of these species will be conducted during the recommended planting period for this region which is in the fall following the onset of frosts, or during the spring.

Selected woody plants obtained either as on-site root cuttings, seedlings, or from commercial nursery stock will be transplanted onto the proposed mitigation site. All species to be planted will be selected from the list of wetland plants known to grow in this area as identified in the wetland field sampling. Native willows

and cottonwoods will also be planted to promote the establishment of riparian cover. A list of species which may be planted is contained in Appendix D. All transplanting operations will be supervised by a reclamation or wetland specialist experienced in the proper handling and planting of these species.

7.0 MITIGATION SUCCESS CRITERIA

The following criteria will be used as the standard by which to measure the success of the wetland creation efforts.

1. A minimum of 7.14 acres of self-sustaining wetlands must be constructed and prove successful to meet existing mitigation needs. This acreage will be calculated as the sum of all wetlands creation areas that meet each of the subsequent criteria.

2. A minimum of 7.14 acres will be saturated to the surface or inundated for at least 10 consecutive days during the growing season.

3. The existing fence which surrounds the proposed wetland mitigation site will be monitored and maintained for a period of not less than five (5) years to exclude any livestock grazing use of the site.

4. Wetland areas will be dominated by vegetative species having an indicator status of FAC, FAC wetland or obligate wetlands as defined by the Current Indicator Species List.

5. A minimum of three (3) nesting islands will be constructed.

6. The vegetative cover within the wetland creation area will be deemed to be successful when the vegetative sampling data collected from the site equals 80 percent of the herbaceous plant cover from undisturbed wetlands as documented in the original wetlands delineation sampling conducted during 1992 by IME Wetlands Consultants.

Self-sustaining wetlands acreage, as defined above, created as a result of the implementation of this plan which exceeds the specified acreage will be "banked" for future wetland mitigation.

8.0 MITIGATION MONITORING

The H-Pit wetland creation area will be monitored to assess the relative success of the mitigation as measured against the criteria set forth in Section 7.0 of the revised mitigation plan. Created wetlands will be monitored for at least five (5) consecutive growing seasons. Additionally, the success of the compensatory wetlands mitigation, without human intervention, will be documented for three (3) consecutive growing seasons once the success criteria have been met. The three (3) and five (5) year periods may run concurrently should human intervention end prior to completion of the fifth year of monitoring. Mitigation monitoring will commence upon completion of the Phase II wetlands development activities. Compensatory mitigation for the wetlands disturbance described in the Jerritt Canyon Project Area PDN, dated November 17, 1993, will be deemed successful, and IMCI's attendant responsibility will be relinquished when the success criteria have been met for three (3) consecutive years without human intervention.

Mitigation monitoring will consist of quantitative vegetation and hydrological data acquisition with a suitable number of samples to document whether the success criteria have been met. Surface water elevations in representative areas within the mitigation site will be monitored and recorded monthly during the growing season. The locations of surface water monitoring staff gauges will be shown on an as-built plan view drawing which will be submitted to the COE upon completion of the Phase II wetlands development activities. Additionally, surface water quality monitoring analytical results for total dissolved solids, chloride, and electrical conductivity will be obtained annually.

Photo points will be established to qualitatively monitor vegetation trends in representative areas of the mitigation site. Photos will be taken annually at the peak of the growing season until monitoring activities have been completed. Vegetative maps showing the plant community types established within the mitigation site will be prepared and submitted annually. A description of each plant community including the vegetative species which occur within each plant community type and their estimated percent aerial cover will also be documented. Vegetative sampling will be conducted by qualified personnel in a manner consistent with sound scientific practice acceptable to the COE.

Monitoring efforts will serve to achieve the following:

1. Determine the success of the mitigation effort.

2. Determine annually the need for supplemental planting and/or seeding.

3. Determine the necessity of weed control.

4. Determine whether there is a need to physically modify the created wetland to ensure success.

The monitoring results will be summarized into an annual Wetland Mitigation Monitoring Report which will be submitted to the COE by January 31 for each year that monitoring activities are conducted. This report will summarize the results from the previous year and describe any corrective measures taken.

9.0 REMEDIAL ACTIONS

If the annual monitoring activities indicate that either the desired vegetation composition or hydrological conditions within the wetland creation area are not being achieved, IMC will initiate appropriate remedial actions. Possible corrective actions which could be implemented include: reseeding or transplanting, raising or lowering the hydrological control structures, removal of dead vegetation, sediment control, weed control or animal control.

10.0 DEED RESTRICTION

IMCI will submit a permanent deed restriction with a legal description of the H-Pit wetlands mitigation area, and the requirements for obtaining approval from COE for implementing any activities that would adversely affect the created wetlands in accordance with applicable law. The permanent deed restriction will be in place prior to the implementation of the Phase II construction activities.

Table 1
Proposed Wetland Impacts by Wetland Plant Community Type

Location	Plant Community Type to be Impacted		Sampled	%	Extrapolated Total
Jerritt Canyon[1]	Meadow Barley		0.034	3.9	0.139
Study Area[1]	Baltic Rush		0.034	3.9	0.139
		subtotal:	0.068	7.8	0.278
Burns Basin[1]	Geyers Willow/Beaked Sedge		0.302	34.6	1.236
Study Area[2]	False Hellebore		0.038	4.4	0.156
		subtotal:	0.340	39.0	1.392
Winters Creek					
Study Area[3]	Geyers Willow/Mesic Graminoid		0.439	50.3	1.797
California Mtn.					
Study Area[2]	False Hellebore		0.025	2.9	0.102
		TOTAL:	0.872	100.0	3.570

Source: IME Wetlands Consultants, 1993

Note: [1] Riparian Wetlands Located Adjacent to Drainage Bottoms
[2] Springs and Seeps Adjacent to Drainage Bottoms
[3] Isolated Springs and Seeps

Table 2
Typical Vegetative Characteristics of the Geyers Willow/Mesic Graminoid Wetland Plant Community (Percent Aerial Cover)

Species	WC-4	CD-23	WC-1	Total	Average
Baltic Rush	53	15	63	131	43.67
Geyer Willow	35	17	32	84	28.00
Woolly Sedge		27		27	9.00
Meadow Barley		12		12	4.00
Fowl Bluegrass	7		5	12	4.00
California False Hellebore			11	11	3.67
Brook Saxifrage		8		8	2.67
Kentucky Bluegrass		6		6	2.00
American Bistort		6		6	2.00
Broad-Leaf Bluebell	4			4	1.33
Shore Buttercup		4		4	1.33

Source: IME Wetlands Consultants, 1993

Table 3
Typical Vegetative Charateristics of the
Geyers Willow/Beaked Sedge Wetland Plant Community
(Percent Aerial Cover)

Species	BBD-11	BBD-12	BBN-7	BBPN-15	PHR-2	CD-2	CD-9	CD-17	CD-27	CDa-7	Total	Average
Geyer Willow	31	39	30	51	22	58	63	63	16	40	413	41.30
Clustered Field Sedge		5			32	21	32	26	21	30	167	16.70
Small Winged Sedge				21	17		19	6	11	19	93	9.30
Golden Current						24		38		15	77	7.70
Shore Buttercup				5		9			31		45	4.50
Columbian Monkshood							26	17			43	4.30
Smooth Willow-Herb	9	19	8		7						43	4.30
Tufted Hairgrass	7	4	9		21						41	4.10
Nasturtium	14	23									37	3.70
Meadow Barley							17		6	12	35	3.50
Woolly Sedge				16					10	6	32	3.20
Curly Dock	4	12			12						28	2.80
Nebraska Sedge	3		13								16	1.60
Brook Saxifrage				4				12			16	1.60
California False Hellebore					4	11					15	1.50
Nodding Bluegrass					14						14	1.40
Popcorn-Flower							11				11	1.10
Common Dandelion		6						4			10	1.00
Fowl Bluegrass							7				7	0.70
Stinging Nettle				6							6	0.60
Western Mountain Aster										5	5	0.50
Kentucky Bluegrass								5			5	0.50
American Bistort			4								4	0.40
Bog Violet											0	0.00
Baltic Rush											0	0.00

Source: IME Wetland Consultants, 1993

Table 4
Typical Vegetative Characteristics of the False Hellbore Wetland Plant Community (Percent Aerial Cover)

Species	SNC-3	WSC-2	MCA-4	CD-15	CD-18	CHR-6	CHR-8	CHR-9	CDa-4	CDa-28	Total	Average
California Flase Hellebore	23	14	23	68	42	32	28	32	29	20	311	31.10
Small Winged Sedge			9		17		16		20	23	85	8.50
Shore Buttercup			8	8	7	42	5	7			77	7.70
Meadow Barley						12	14	13			39	3.90
Quaking Aspen				15				23			38	3.80
Nodding Bluegrass		16								18	34	3.40
Stinging Nettle	8	12	14								34	3.40
Broad-Leaf Bluebell					22				10		32	3.20
Western Groundsel				18	6						24	2.40
Cow-Parsnip	21										21	2.10
Fowl Bluegrass			19								19	1.90
Western Mountain Aster										18	18	1.80
Kentucky Bluegrass				6			12				18	1.80
Field Mint	17										17	1.70
Soft Cinquefoil									15		15	1.50
Baltic Rush									12		12	1.20
Louisiana Sagewort				5			6				11	1.10
Western Yarrow									6		6	0.60
Tufted Hairgrass	6										6	0.60
Sticky Cinquefoil										6	6	0.60
Geyer Willow	5										5	0.50
Willow-Weed		3									3	0.30
Consultants												

Source: IMC Wetland

Table 5
Typical Vegetative Charactertics of the Meadow Barley Wetland Plant Community (Percent Aerial Cover)

Species	CJ-15	CJ-7	BBPN-4	SNC-4	Total	Average
Meadow Barley	42	10	24	33	109	27.25
Nodding Bluegrass	21	11		16	48	12.00
Curly Dock	2	9		11	22	5.50
Creeping Bentgrass			17		17	4.25
Tufted Hairgrass				13	13	3.25
Bull Thistle	11				11	2.75
Small Winged Sedge	4		7		11	2.75
Fowl Bluegrass				9	9	2.25
Stinging Nettle	8				8	2.00
Bog Violet			6		6	1.50
Quaking Aspen			2		2	0.50

Source: IME Wetland Consultants

Table 6
Typical Vegetative Characteristics of the Baltic Rush Wetland Plant Community (Percent Aerial Cover)

Species	CDa-1	JC-18	JM-5	Total	Average
Baltic Rush	35	42	34	111	37.00
Nasturtium		19		19	6.33
Creeping Bentgrass		6	13	19	6.33
Clustered Field Sedge	15			15	5.00
Soft Cinquefoil	15			15	5.00
Western Mountain Aster	12			12	4.00
Bull Thistle		12		12	4.00
Nodding Bluegrass		3	8	11	3.67
California False Hellebore	10			10	3.33
Western Yarrow	8			8	2.67
Tufted Hairgrass		4		4	1.33
Curly Dock			3	3	1.00
Kentucky Bluegrass	2			2	0.67

Source: IME Wetland Consultants

Appendix D

Bioligical Assessment

BIOLOGICAL ASSESSMENT
Jerritt Canyon Mine Expansion Project
Mountain City Ranger District
Humboldt National Forest

I. INTRODUCTION

Threatened and endangered species are managed under the authority of the Federal Endangered Species Act (PL 93-205, as amended) and the National Forest Management Act (PL 94-588). The Endangered Species Act requires federal agencies to ensure that all actions are not likely to jeopardize the continued existence of any threatened or endangered species.

The USDA Forest Service has developed policy regarding the designation of Sensitive plant and animal species. A sensitive species is defined as (FSM 2670.5) those plant and animal species identified by the Regional Forester for which population viability is a concern as evidenced by: 1) significant current or predicted downward trends in population numbers or density or 2) significant current or predicted downward trends in habitat capability that would reduce a species existing distribution.

The Forest Service objective for sensitive species management (FSM 2670.22) is to "develop and implement management practices to ensure that species do not become threatened or endangered because of Forest Service actions." In addition, the National Environmental Policy Act (PL 91-190 42 U.S.C. 4321-4347) directs that the Forest Service "review programs and activities ... to determine their potential effect on sensitive species".

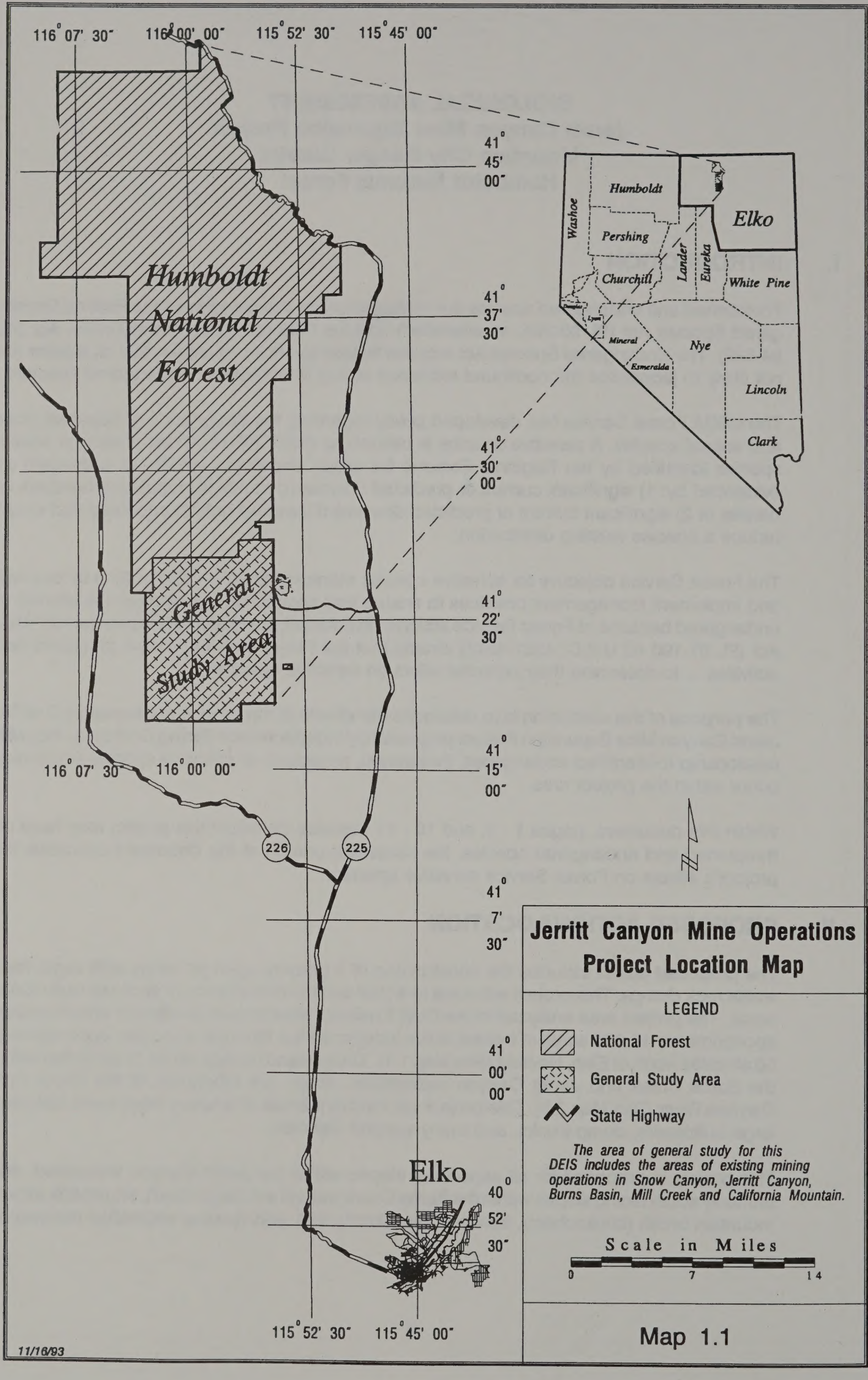
The purpose of this evaluation is to determine the effects of the proposed Alternative C of the Jerritt Canyon Mine Expansion Project proposed by Independence Mining Company, Inc. with relationship to identified endangered, threatened, proposed, or sensitive species which may occur within the project area.

Within this document, pages 1 - 5, and 10 - 11 describe the effect this project may have on threatened and endangered species, the remaining portion of the document describes the project's effects on Forest Service sensitive species.

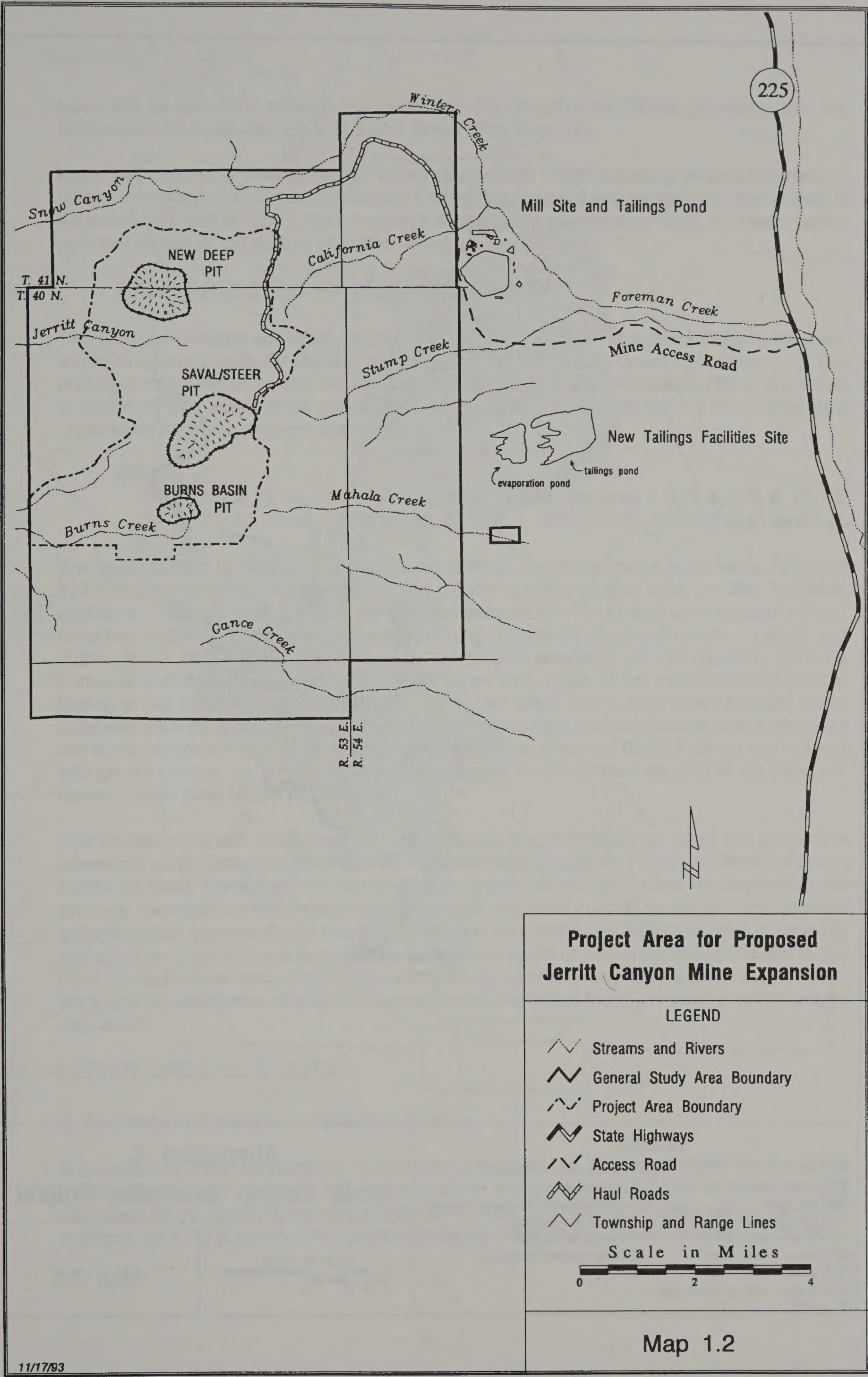
II. PROPOSED ACTION/LOCATION

The proposed action includes the construction of 3 primary open pit mines with associated waste rock dumps. This project will result in a total surface disturbance of approximately 2,662 acres. The project area analyzed in the Draft Environmental Impact Statement encompasses approximately 11,000 acres of habitat in the Independence Mountains located approximately 50 air miles north of Elko, Nevada (See Map 1.1). The pits and dumps will be constructed within the Burns Creek and Jerritt Canyon watersheds, which are tributaries of the South Fork Owyhee River (See Map 2.5). This project will involve the use of a heavy equipment including large bulldozers, dump trucks, and many support vehicles.

This project is proposed for all aspects of slopes within the Jerritt Canyon watershed, and primarily south facing slopes within the Burns Creek watershed. Sage brush, snowbank aspen, mountain brush (chokecherry, serviceberry, bitterbrush), and riparian vegetation community



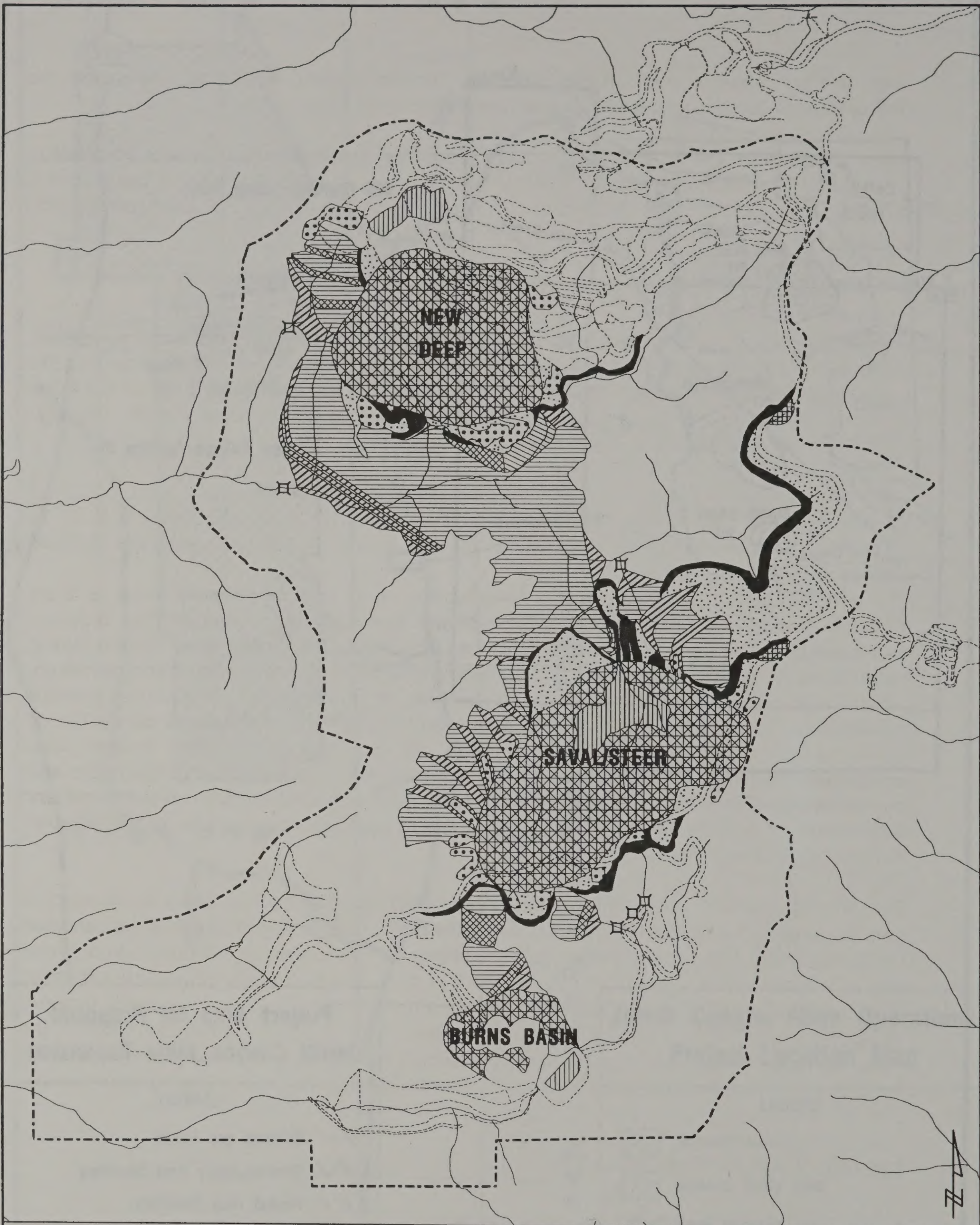
116° 07' 30"
116° 00' 00"
115° 52' 30"
115° 45' 00"
41° 45' 00"
41° 37' 30"
41° 30' 00"
41° 22' 30"
41° 15' 00"
41° 7' 30"
41° 00' 00"
40° 52' 30"
Humboldt National Forest
General Study Area
226
225
Elko
Humboldt
Washoe
Pershing
Churchill
Lander
Eureka
White Pine
Mineral
Esmeralda
Nye
Lincoln
Clark
Jerritt Canyon Mine Operations
Project Location Map
LEGEND
National Forest
General Study Area
State Highway
The area of general study for this DEIS includes the areas of existing mining operations in Snow Canyon, Jerritt Canyon, Burns Basin, Mill Creek and California Mountain.
Scale in Miles
0
7
14
Map 1.1
11/16/93



Project Area for Proposed Jerritt Canyon Mine Expansion

Map 1.2

11/17/93



LEGEND

- Pits
- Ore Stockpiles
- Haul Roads
- Partial Pit Backfills
- Dumps - Relatively Flat
- Dumps - 3H:1V Slopes
- Dumps - 2H:1V Slopes
- Dumps - Angle of Repose Slopes
- Growth Medium Stockpiles
- Undisturbed Areas
- Existing/Approved Disturbance Boundaries
- Project Area Boundary
- Streams (USGS)
- Major Sediment Ponds/Traps

SCW : 11/13/93

Alternative C
Jerritt Canyon Expansion Project

Scale in Miles

0 1/8 1/4 1/2 1

Map 2.5

types will be impacted through this proposal. The disturbance will be occurring near the headwaters of Jerritt Canyon and Burns Creek (See Map 1.2).

Major reclamation and rehabilitation would presumably begin following project completion, unless mineral resources present warrant further development and exploration. The project is expected to continue mine activities within the area until approximately 2002, with reclamation activities probably continuing after this date for a few years.

III. AREA AFFECTED BY THE PROPOSAL

The proposed actions will affect resources in the Jerritt Canyon and Burns Basin watershed, which lie approximately 50 air miles north of Elko, Nevada in Elko County (See Map 1.1). The project is contained on Forest Service administered lands at approximately 6,000 to 8,000 feet in elevation with some small private land inholdings within the National Forest. The legal description for these projects are as follows:

Portions of:

Sections 28, 32, 33, 34, & 35, T. 41N., R. 53E., Sections 1, 2, 3, 4, 5, 8, 9, 10, 11, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, &28, T. 40N., R. 53E., Mount Diablo Meridian.

The area affected by this proposal has been actively developed for minerals since 1976 and includes several disturbance sites outside of the specific project area for this proposal. Associated federal, state, and private activities surrounding the project area include mining, ranching, and recreational vehicle travel. Ranching of domestic livestock occurs on private and federal lands both within and adjacent to the project area with private ranching primarily concentrated to ranches in the valley bottoms on both sides of the Independence Range. Mining in the form of haul roads, access roads, mill sites, and tailings pond facilities occur adjacent to the project area on private and public lands. Haul roads accessing the project area are constructed primarily on National Forest lands and are used to haul ore to the mill and tailings site located on Bureau of Land Management lands on the east side of the Independence Range (See Map 1.2).

The project area with associated mining and ranching activities has been the subject of numerous consultations with the Fish and Wildlife Service regarding the threatened Lahontan Cutthroat Trout. Consultations occurring for mining exploration and mine development have primarily focussed on the proper management of sediment caused by project disturbances including road construction. It has been a requirement of the U.S. Forest Service to properly manage the construction and maintenance of these roads to prevent adverse impacts to the trout. Consultations occurring for livestock grazing have primarily focussed on the development and administration of allotment management plans that focus on grazing within proper use levels.

IV. LISTED SPECIES/HABITAT

A. *Threatened / Endangered / Sensitive Species*

A threatened (T) and endangered (E) species list from the U.S. Fish and Wildlife Service (FWS 1-5-93-SP-423) was obtained for a project within the general study area of this DEIS and confirmed for use on this project by phone on 12/7/93. The species list included the Lahontan cutthroat trout (T) (*Oncorhynchus clarki henshawi*). Additionally, Lewis's buckwheat (S) (*Erio-*

gonum lewisii), Howell dimersia (S) (*Dimersia howellii*), Meadow pussytoes (S) (*Antennaria arcuata*), Broad fleabane (S) (*Erigeron latus*), Spotted frog (S) (*Rana pretosa*), Spotted Bat (S) (*Euderma maculatum*), Pacific Western Big-eared Bat (S) (*Plecotus townsendii townsendii*), and the Northern Goshawk (S) (*Accipiter gentilis*) are included in pages 6 - 10 of this assessment because of their designation as U.S.F.S. Region 4 sensitive (S) species.

No additional threatened, endangered, sensitive, or proposed plant or animal species are suspected of occupying or having the potential to occupy habitat in the project area. As the DEIS prepared for this project discusses species including the Bald eagle (E) (*Haliaeetus leucocephalus*) and the Peregrine falcon (E) (*Falco peregrinus anatum*), these species will also be analyzed in pages 1 - 5 of this assessment even though they were not deemed necessary to analyze by the USFWS.

B. Species Description / Affected Environment

Lahontan Cutthroat Trout

A detailed life history of the Lahontan Cutthroat trout can be found in Coffin (1982) and a discussion of the possibility of a Humboldt subspecies in Behnke (1992). The only portion of this project that relates to Lahontan Cutthroat trout habitat is the haul road that is located outside of the project area that travels through Winters Creek for 5.2 miles and California Creek for 0.5 mile. Both of these streams provide habitat for this species (See Map 1.2). No additional disturbances will be occurring to California Creek or Winters Creek through this proposal. The project area is contained within the Burns Creek and Jerritt Canyon watershed, no new disturbances will occur to the California Creek or Winters Creek watersheds. California Creek has been documented to contain Lahontan Cutthroat trout (NDOW, 1978) and is classified as an essential recovery site for the species (USFWS Draft Recovery Plan, 1993). Winters Creek has been documented to contain this species, however it is listed as a potential (less value than essential) recovery site for the species (USFWS Draft Recovery Plan, 1993). Winters Creek provides less suitable habitat than California Creek.

California Creek provides habitat for a small population of Lahontan Cutthroat trout. Surveys in 1978 found approximately 105 fish/mile with a total population of approximately 220 fish. These fish were documented to primarily rely upon beaver ponds within the stream for summer and winter habitat. California Creek is a relatively small stream that is intermittent within the project disturbance area and becomes perennial downstream near the crossing of the Jerritt Canyon mine haul road. The creek provides habitat for an isolated population that most likely does not migrate out of the North Fork Humboldt river due to disturbances downstream. 1,100 acres of the watershed was burned in 1992 during the California Mountain Fire. This fire was situated beneath the road crossing in Section 31 mentioned above. There were signs of high sediment loads in the spring of 1993 following winter runoff and many beaver dams that had burned did not withstand the high spring flows (Warder, 1993). Initial dissolved oxygen monitoring in May of 1993 did not show any concerns with readings of 10.0 mg/l, however this sample was taken at the end of the peak flow period (Warder, 1993). Dissolved oxygen samples taken in 1991 were at approximately 8 mg/l in July. Much of the burned area was seeded in the fall of 1992 to attempt to stabilize slopes prior to spring runoff. Regeneration and growth of shrubs, aspen, and seeded species appears to be doing well in 1993. Macroinvertebrate samples taken at the road crossing in Section 31 and just above the culvert under the main haul road in 1991 indicate that the aquatic community is in poor condition, with many sediment tolerant taxa present and very few cleanwater taxa present. It is not clear as to the reasons for these results, however excessive livestock grazing has occurred in the past. Very

limited minerals exploration disturbance and no mining disturbance has occurrred within the watershed. No fish population sampling has occurred within the creek since 1978. However, LCT and dace have been sighted in the creek in 1992 and 1993 (Anderson, 1993). California Creek is currently proposed for livestock grazing under the East Independence AMP pending a riparian fence construction and rest from the fire in 1992.

Winters Creek has had limited population sampling or habitat parameters defined. Macroinvertebrate sampling has been conducted in 1991 and 1992. Results indicate several species that exhibit low tolerance to sedimentation still inhabit the stream, which is after a sediment flow related to mining disturbances occurred in 1990. Sampling will continue as specified in the Winters Creek Environmental Assessment to monitor impacts after mining activity began in 1993. Fish population sampling has been conducted in 1992 and 1993. LCT fry have been documented to occur in the stream in electro-shock surveys conducted by IMCI in 1993, which was a particularly high water runoff year. Past livestock and mining impacts to this stream may have degraded the quality of habitat within this stream due to increased sediment loading. To mitigate this effect, IMCI constructed a riparian exclosure fence along the upper portion of Winters Creek in 1993. Livestock will be excluded from this pasture to help mitigate effects of increased sediment loads anticipated from the construction of previously approved waste rock dumps in 1993 and 1994 within Winters Creek. In addition, habitat monitoring will continue within Winters Creek as required through previous environmental assessments.

Bald Eagle

As described in the DEIS, bald eagles are annual winter migrants to Nevada. Bald eagles have been spotted in 1992 and 1993 in the North Fork Humboldt River valley apparently migrating through the region (Warder, 1993). The project area does not provide any critical or suitable habitat for bald eagles due to the lack of water and abundance of prey species. No bald eagles have been found nesting in the Independence Range.

Peregrine Falcon

As described in the DEIS, peregrine falcons are residents in Nevada. However, no peregrine falcons have been seen in or near the project area but they may pass through the area on their way to other locations. Jerritt Canyon lacks suitable cliffs for nesting habitat, however cliffs within the Burns Basin watershed may have potential to provide nesting habitat.

V. EFFECTS OF PROPOSED ACTION ON THREATENED/ENDANGERED SPECIES

A. Direct Effects

Lahontan Cutthroat Trout
Direct effects to the Lahontan Cutthroat trout (LCT) would be impacts to the fish population or habitat. As no new disturbance will be occurring within either California Creek or Winters Creek as a result of this project, there will be no direct affects associated with this species.

Bald Eagle and Peregrine Falcon
As neither of these species occur within the project area nor does suitable habitat occur, there will be no likely direct effects to either of these species.

B. Indirect Effects

Lahontan Cutthroat Trout
The potential indirect impact to the Lahontan Cutthroat trout would be the introduction of sediment into California Creek or Winters Creek from the continued use of the mine haul road. Sediment could potentially smother fish eggs incubating in streambed gravel, smother macroinvertebrate populations important as prey, or interfere with normal development of fry among other complications in the morphology of the stream. No new road construction would occur to generate excess sediment as a result of this proposal. The haul road that crosses California Creek and disturbs a portion of the Winters Creek watershed has been analyzed through previous NEPA documents. However, these projects did not anticipate the longer lifespan of the haul road as it will now be used through 2002 by mining activities and possibly longer for reclamation activities as specified by this proposal. This haul road has not been maintained to an acceptable condition that prevents sediment from entering Winters Creek or tributaries to Foreman Creek within past years. The road has been improved in 1993 with 5 additional runoff and sediment trapping structures constructed and enlargement of existing structures to facilitate maintenance. Results of this effort will be examined through weekly inspections by Forest Service personnel during the winter and spring of 1994 to determine the effectiveness. It is not anticipated that the proposed project will result in significant indirect effects to the Lahontan Cutthroat trout providing that the haul road is maintained as specified by previously approved NEPA documents.

Bald Eagle and Peregrine Falcon
As neither of these species nor suitable habitat for these species occurs within the project area, there are no indirect effects anticipated as a result of the proposed action.

C. Cumulative Effects

Lahontan Cutthroat Trout
The riparian pastures created within Winters Creek and California Creek should help improve the quality of habitat in both of these streams over the existing condition. Through previous NEPA documents, IMCI has agreed to continue monitoring habitat for LCT within Winters Creek and California Creek through fish population sampling in both streams and macroinvertebrate sampling within Winters Creek. The Forest Service will be monitoring macroinvertebrate conditions within California Creek in 1994 to complete baseline data for management recommendations. It is not anticipated that this proposal will have an increased cumulative effect on either of these watersheds as project disturbance is occurring entirely outside of both of these watersheds. Cumulative impacts also include the potential dewatering of California Creek, Winters Creek, and other tributaries of the North Fork of the Humboldt River from dewatering of mining pits associated with the proposed action. As the geologic dip of ground water resources is toward the west within the project area, dewatering activities are not expected to affect water resources on any streams on the east side of the Independence Range (Butler, 1993). Additional cumulative impacts in the general study area include the continued operation of the mill and tailings facility located on BLM land on the east side of the Independence Range. Mining exploration and livestock grazing will also continue within the watershed. No additional cumulative impacts are anticipated from these other federal, state, and private activities.

Bald Eagle and Peregrine Falcon
As neither of these species nor potential habitat occur within the project area, it is not anticipated that any cumulative effects will occur to either of these species.

VI. SENSITIVE SPECIES DESCRIPTION/HABITAT

Lewis' Buckwheat

Lewis' buckwheat is a low, rounded perennial herb found on barren, gravelly knobs and summits at relatively high elevations (Reveal, 1985). This species has been located approximately 5.3 air miles northwest of the Saval Ranch, NE 1/4 Section 14, T.40N., R.53E., at an elevation of 8350 feet. This location adjoins the project area.

Howell Dimersia

Howell dimersia is a small and low growing annual plant that occupies dry, gravelly, or rocky volcanic soil at approximately 3,900 to 7,600 feet (USDAFS, 1991). The plant has been identified in the Santa Rosa range and is suspected to inhabit the Independence range in Gance Creek (T.40N,R.53E,S26&35 and T.39N,R.53E,S2) referenced by Kartesz, 1987. This location is approximately 8 air miles south of the project area. In addition, the species has been found in the Dorsey Creek area near the Big Springs mine in the Independence Range (Morefield, 1993).

Meadow Pussytoes

Meadow pussytoes is a short-lived plant that occurs in sedge-grass meadows between 5,000 and 6,500 feet (USDAFS, 1991). The closest known location of this species is approximately 25 air miles northeast of the project area in Section 32, Township 45N, Range 55E.

Broad Fleabane

Broad fleabane is a short perennial herb that grows in thin soil on rocky or gravelly hillsides or volcanic sands at approximately 6,400 feet (USDAFS, 1991). The closest known location of this species is in Gance Creek approximately 5 air miles south of the project area in Section 5, Township 39N, Range 54E.

Spotted Frog

The spotted frog is a highly aquatic species found in the vicinity of cold, permanent bodies of water - streams, rivers, marshes, springs, pools and small lakes. The spotted frog is an opportunistic insectivore. Activities which affect invertebrate habitat, and subsequently invertebrate populations, may be the cause in spotted frog population declines in an area (Quigley et. al. 1989). Stebbins (1966), indicated that the spotted frog can be found in isolated populations in the Humboldt River Drainage. A spotted frog was sited near a spring source at the mouth of North Fork Humboldt River (Ports, 1990). Spotted frogs were also observed in June of 1991 (Ports) in Mill Creek which is approximately 12 miles from the project area. No spotted frogs were found during surveys in 1992 on the Mountain City district by Ports or NDOW. Surveys conducted by IMCI for the Jerritt Canyon and Doby George Creek project areas also identified spotted frogs (JBR, 1992), however no frogs were found within the project area to be disturbed through this proposal.

Spotted Bat

Spotted bats inhabit a diversity of grass, desert and pinyon/juniper and ponderosa pine habitats (Watkins, 1977). Most collections have been in dry rough desert terrain. However, more collections are coming from forest sites (Woodsworth, et. al. 1981; and Berna 1990). They roost alone in steep cliff faces having cracks or crevices. They are thought to migrate to winter hibernacula. Spotted bats eat mainly moths (Watkins, 1977; Wai-pong and Fenton, 1989) but have been observed feeding low to the ground and even dropping to the ground to capture a grasshopper (Poche and Bailie 1974). In a Canadian study, spotted bats foraged alone in a variety of habitats with a preference over marshes and open ponderosa pine (Wai-pong and Fenton 1989). Spotted bats may be sensitive to human activity.

Ports (1991), surveyed for bats on the Mountain City Ranger District for 3 nights. Ports also surveyed in 1992 for bats on the Mountain City District. No spotted bats were collected. Surveys conducted by IMCI in the Jerritt Canyon and Doby George Creek project areas did not identify any spotted bats (JBR, 1992). Spotted bats have not been identified anywhere on the District. Suitable roosting habitat is limited in the project area.

Pacific Western Big-eared Bat

The western big-eared bat is found throughout western North America and is widely distributed in Nevada (Hall, 1946) and in the great Basin. Western big-eared bats use a variety of grassland/shrub and forested habitats up to 10,000 feet (Kunz and Martin, 1982). The species inhabits caves (Hall, 1946). Hibernacula may be caves, mine shafts, rocky outcrops or old buildings. They roost singularly or in small numbers in exposed, open areas of the cave. Big-eared bats are very sensitive to human disturbance and will abandon roosts if disturbed (Kunz and Martin 1982). Low reproductive rates and limited roost sites make this a vulnerable species.

Ports (1991), surveyed for bats on the Mountain City Ranger District for 3 nights. Ports also surveyed for bats in 1992 on the Mountain City District. No big-eared bats were collected. Surveys conducted by IMCI for the Jerritt Canyon and Doby George Creek project areas did not identify any big-eared bats (JBR, 1992). Western big-eared bats have not been identified anywhere on the District. It is unlikely that this species is found within or near the proposed activities due to the lack of suitable habitat in the area.

Northern Goshawk

The northern goshawk is a summer resident of the Mountain City Ranger District. Goshawks nest in mature aspen community types. Limited information is available for goshawk behavior or habitat characteristics of the Great Basin. A study was initiated the summer of 1991 to describe goshawk behavior and habitat in the Independence Mountains. Preliminary data show that the nest tree is the largest aspen tree in the stand (23-30 cm) with very little cover below the canopy. Slope of nest stand was 8%-34% on north or east aspects. Water, in the form of streams or springs, were usually present within 100 meters. Goshawks may select large trees associated with mesic conditions rather than the water itself.

Other studies have shown that goshawks have comparatively large home ranges of up to 6000 acres (Reynolds, 1979). Within the home range is a small (25 acre) nest territory actively defended by the adults (Reynolds, 1983), and a 600 acre Post Fledgling Area (PFA). PFA's have been identified by the Southwest Region management guidelines and represent the core

area used by female goshawks and fledged young during the young's dependancy on the adults. The PFA includes foraging areas for the adults and fledglings, hiding and security cover, and alternate nest sites. There can be several alternate nest sites in a PFA. Only one nest site in a PFA will be active in any given year.

The remaining 5375 acres of home range (home range minus PFA and nesting territory) are devoted to foraging. Foraging has been documented in timber areas to occur in heavy canopied forests with open understories. Direct correlation to Great Basin goshawk foraging habitat is questionable. Goshawks in the Independence Range have been observed foraging within aspen stands, in small sagebrush inclusions in aspen stands, along aspen stand ecotones, and in open sagebrush conditions. Since goshawks generally use perches to identify prey while hunting, it is not expected that goshawks utilize vast expanses of non-tree community types while foraging.

Studies relating to home range, territory size, and Post Fledgling Areas have been conducted in heavily timbered areas on other national forests, and direct correlation to Great Basin habitats is questionable. Home ranges, foraging areas, PFA's and nesting territories may be somewhat larger in the Great Basin due to limited favorable habitat types, primarily aspen.

Fifty seven nest sites have been identified in the Independence and Bull Run Mountains with the use of aerial and/or ground surveys. Twenty-four of these nests were ground truthed in 1991 to check for nest status. Fourteen nests were initially identified as active. Eight of fourteen nests were successful and produced an average 2.25 young (based on egg and/or nestling counts). Number of young fledged (which would be expected to be lower than egg and nestling counts) is not available. As a note of comparison, during 1978 and 1979 surveys, seventeen nests sites were active. The success of these nests is unknown. With more complete and widespread surveys in 1992, 22 nests were active and an average of 2.7 young were fledged per nest. During 1993 surveys, 21 out of 25 nests were active and produced an average 2.4 young per nest. At this time it is difficult to draw conclusions from this data and to determine the effect, if any, that mining disturbances have on nesting success. From the 1992 report from Boise State University, there was no difference in nesting success between nests within delineated PFA's near disturbance and nests located further from disturbance. This may show that some birds are capable of habituating to mining operating noises, while others may still benefit from temporal and spatial restrictions enforced through PFA's. The 1993 report is not completed. Approximately 335 acres of aspen habitat within the project area have been removed prior to disturbances proposed in this action.

This project is located within the home range of several goshawk nests and within several PFA's. Disturbances to affected nests including #02791, 02691, 03791, 03991, 07491, 12791, 12891, 13491, 13691, and 14391 which represent 6 nesting territories were analyzed through the EIS process. Of these nests, #027, 037, 039, 136, and 143 have been observed to be active since 1991.

VII. EFFECTS TO SENSITIVE SPECIES

A. DIRECT EFFECTS

Sensitive plants
A field survey for sensitive plants was conducted in 1992 and again in 1993 for all of the sensitive plants listed previously (JBR, 1992, 1993). No sensitive plants were documented to occur within the project area. No direct effects should occur to any of these plants.

Spotted frog
The spotted frog should not incur any direct effects. Surveys conducted within the project area did not locate any spotted frogs.

Bats
Potential roosting and/or hibernacula sites for spotted and big-eared bats will not be impacted by this proposal (JBR, 1992). Potential foraging habitat will be temporarily impacted due to removing vegetation during road construction. No direct effects should occur to the spotted or big-eared bats.

Goshawks
This project will directly remove three potential goshawk nests (#074, 127, & 128) which represent one nesting territory. These nests nor the aspen stands in which they are constructed will no longer provide suitable habitat for goshawks. There should be no direct effects to any individuals of the species providing nests are removed prior to onset of the breeding season in March of 1993.

B. INDIRECT EFFECTS

Sensitive plants
Indirect effects to the sensitive plants may include surface flow of dirt or sedimentation over known populations. As no plants or potential habitat was found during surveys, no indirect effects should occur to any sensitive plants.

Spotted frog
Spotted frogs may also be indirectly affected by excessive sediment loads or riparian habitat modification. As no spotted frogs were found within the project area, it is not likely that spotted frogs will incur any indirect effects from this project.

Bats
Evidence in the literature suggests that spotted and big-eared bats are vulnerable to human activities around roosting and/or hibernacula sites. As no sensitive bat species were detected during surveys, it is not likely that indirect effects would occur to either bat species from this project.

Goshawk
The potential indirect effects of this proposal on the northern goshawk are nest abandonment due to activities near nest sites, reduction in nest productivity, reduction in young growth and development and/or the displacement of goshawks from prime foraging areas to other potentially inferior areas. These impacts may occur when activity is found within active PFA's. This project is located within the Steer/Saval PFA established for nests #074, 127, & 128 and the

Burns Basin PFA established for nests #134 and 136. As nest #'s 074, 127, and 128 will be removed prior to any nesting activity that normally occurs in March, there should be no indirect effects to any individuals of the species. It is not clear if the aspen stands surrounding these nests have been prime foraging areas, as goshawks near the area have been observed to feed away from mining activity. The aspen stands surrounding the nests within the Steer/Saval PFA will no longer provide prime foraging habitat after implementation of this proposal. The Burns Basin PFA is located adjacent to actively mined pits. Such close mining activity has not caused these nests to fail or experience a reduction in productivity in the past. It is not clear if the same nesting pair continually uses this nest or if a new nesting pair would be significantly displaced by mining activity. Indirect effects are not likely to occur to goshawks nesting within the project area, however it is not known if this trend will continue.

C. CUMULATIVE EFFECTS ON SENSITIVE SPECIES

Sensitive plants
No methodology has been developed at this time to track the cumulative effects on any of the sensitive plant species. Cumulative effects associated with this project may include the disturbance of potential habitat, of which some potential habitat was found for Lewis' buckwheat. It is not known if the amount of disturbance associated with this project will constitute significant cumulative effects towards the persistence of any of the plant species through a loss of potential habitat.

Frog and bats
No methodology has been developed, at this time, for tracking the cumulative effects on the spotted frog, spotted bat, or the big-eared bat. Potential foraging habitat for bats may be disturbed through this project. However, as no bats have been identified within the project area or on the district, it is not likely that this is a significant cumulative effect. Due to the few number of suitable habitat sites for the spotted frog within the project area, it is not likely that the removal of spring sites within the project area will cumulatively affect populations of spotted frogs.

Goshawk
Home range (6157 acre buffer) is used as the province for the Northern goshawk to analyze cumulative effects. These proposed projects will be taking place within the home ranges for goshawk nests #02791, 02691, 03791, 03991, 07491, 12791, 12891, 13491, 13691, and 14391. The Thresholds of Concern established to track cumulative effects will be exceeded for nests #074, 127, 128, 134, and 136 through implementation of this proposal. It is not clear if the amount of nesting and foraging habitat removed through this proposal will constitute a significant cumulative impact to goshawks that frequent the Independence Mountains. As the Threshold of Concern has been exceeded, IMCI has proposed to mitigate some of this loss through the planting of aspen seedlings and improving aspen stands outside of the project area. However, it is not known if the mitigation will reduce the cumulative impacts to goshawks. Approximately 650 acres of aspen that provide potential nesting and foraging habitat will be removed through this project creating a total loss of approximately 1,000 (including previous) acres or 10% of aspen habitat within the General Study area.

VIII. REQUIREMENTS FOR THREATENED/ENDANGERED/SENSITIVE SPECIES

It will be a requirement of this document to insure that the goshawk nests to be removed (#074, 127, & 128) will be removed prior to the onset of the nesting season in March of 1993 to avoid direct and indirect impacts to any goshawks. If the EIS associated with this document is not

completed before such time, a determination of nest activity by Forest Service or authorized personnel will be necessary. If the nests are not found to be occupied by any bird species, the nests may be removed with appropriate approval.

IX. DETERMINATION

Threatened/Endangered Species

As a result of this evaluation and requirements, it is our professional determination that any alternative identified within the DEIS, due to a similarity of disturbance, is not likely to adversely affect the Lahontan Cutthroat trout and will have no effect on the Bald eagle and Peregrine falcon. The determination made on LCT is based on the following factors: 1) No new road construction will occur within identified LCT habitat corridors (Winters Creek and California Creek), 2) Road improvements including more and enlarged sediment control devices have been established on the portions of haul road that could potentially affect LCT populations, 3) Dewatering is not likely to occur within LCT habitat due to geologic features (dip to the west) in the Independence Range, and 4) Grazing has been excluded within portions of Winters Creek and a riparian pasture established within California Creek thereby lessening cumulative effects to these habitats and LCT populations.

Sensitive Species

This project is not likely to affect or result in a trend toward the federal listing of the following sensitive species: Lewis' buckwheat, Howell dimersia, Broad fleabane, Meadow pussytoes, Spotted frog, Spotted bat, or the Pacific Western Big-eared bat. This project may affect Northern goshawk individuals, however the action is not likely to contribute toward the federal listing of the species.

X. SIGNATURES

Prepared by:

Jon Warder 1/6/94

JON WARDER Date
Wildlife Biologist

Reviewed by:

Steve Anderson 1/10/94

STEVE ANDERSON Date
Forest Wildlife Biologist

XI. GLOSSARY

1.	Activity	As defined in the Requirements section (Section VI), activity pertains to road building and drilling operations.
2.	Alternate Nest Site	PFA's may contain three or more nests, only one of which will be active in a given year.
3.	Home Range	The maximum extent surrounding a nest site in which adults, during the breeding season, travel and forage (approx 6000 acres). The home range is also used as the province for cumulative effects analysis.
4.	Nest Sites	Identified goshawk nests. Does not denote nest status, i.e. Active or inactive.
5.	Nest Stands	The contiguous aspen stand in which a nest site is found.
6.	Nest Territories	Area surrounding a nest site (25 acres) which is actively defended by the adult goshawks.
7.	Post Fledgling Area	Core area used by female goshawks and fledged young during the youngs dependancy on the adults. The PFA includes foraging areas for the adults and fledglings, hiding and security cover, as well as alternate nest sites. Only one breeding pair of goshawks will use a PFA in any given year.

XII. LITERATURE REVIEW AND REFERENCES

1. Alcorn, J.R. 1988. The Birds of Nevada. Fairview West Publ., Fallon NV.

2. Anderson, S. 1993. Field review of California Creek. September 1993. USFS employee. Unpubl.

3. Behnke, R. 1992. Native Trout of Western North America. American Fisheries Society Monograph # 6, Bethesda, Maryland. pp. 13-138.

4. Berna, H.J. 1990. Seven bat species from the Kaibab Plateau, AZ, with a new record of Euderma maculatum. The Southwestern Naturalist. 35(3):354-356.

5. Borell, A.E., and R. Ellis. 1934. Mammals of the Ruby Mountains region of northestern Nevada. J. of Mammalogy 15:12-44.

6. Burt, W.H. and R.P Grossengeider. 1964. A field guide to the Mammals. Houghton Mifflin Company, Boston. 284 pages.

7. Butler, C. 1993. Forest Service hydrologist speaking in reference to ground and surface water resources within the General Study area.

8. Coffin, P.D. 1982. Lahontan Cutthroat Trout Fishery Management Plan for the Humboldt River Drainage Basin. Nevada Dept. of Wildlife. Fed. Aid Proj. F-20-17.

9. Cronquist, A. 1989. Intermountain Flora. New York Botanical Garden. Volume 3, Part B. pp. 208-211.

10. DeGraaf, R.M., et. al. 1991. Forest and Rangeland Birds of the United States - Natural history and habitat use. USDA Agriculture Handbook 688. 625 pages.

11. Hall, E.R. 1946. Mammals of Nevada. UC California Press, Berkeley. 649 pp.

12. Herron, G.B., C.A. Mortimore and M.S. Rawlings 1985. Nevada Raptors. Nevada Dept. of Wildlife. Fed. Aid Proj. W-53-R.

13. JBR Consultants, 1992 and 1993. TES survey of Jerritt Canyon and Doby George Creek project areas. On file at Mt. City RD or IMCI offices. Unpubl.

14. Kartesz, J. 1987. A Flora of Nevada. University of Nevada Reno for PHD.

15. Kennedy, P. 1990. Home ranges of Northern Goshawks nesting in North Central New Mexico: Absract. Managing Wildlife in the South West. Edited by P.R. Krausman and N.S. Smith. 16-18, October 1990. Tucson, AZ.

16. Kunz, T.H. and R.A. Martin. 1982. Plecotus townsendii. Mammalian Species, No. 175, pgs 1-6. The American Society of Mammalogists.

17. Larison, E.J. and D.R. Johnson. 1981. Mammals of Idaho. Univ. Press of Idaho, Moscow, ID. 166 pp.

18. Morefield, J. 1993. Nevada Natural Heritage Foundation employee. Field review of the Dorsey Creek project area and botanical survey.

19. Mozingo, H. N. and M. Williams. 1980. Threatened and Endangered Plants of Nevada. Includes index. 1. Botany - Nevada - Endangered Species. U.S. Fish and Wildlife Service and Bureau of Land Management Illustrated Manaul. 268pp.

20. Platts, W.S. and R.L. Nelson. 1983. Population Fluctuations and Genetic Differentiation in the Humboldt Trout of Gance Creek, Nevada. Cal. Neva. Trans. 1983. Pg. 15-19.

21. Poche, R.M. and G.L. Bailie. 1974. Notes on the spotted bat from southwest utah. Great Basin Naturalist. 34(4):254-256.

22. Ports, M.A. 1991 and 1992. Non-game wildlife report. unpub. On file at Mountain City Ranger District, Mountain City, Nevada.

23. Region 3 Interim Directive No. 2670-91-1. Effective Date June 6, 1991. Expiration Date: June 6, 1992. Requires northern goshawk nest sites and post-fledgling family areas be established and managed whenever a nest tie is located.

24. Reveal, James I., 1985. New Nevada Entities and Combination in Eriogonum (Polygonaceae). Can be obtained through Teri Knight of the Nevada Natural Heritage Program.

25. Reynolds, Richard T. 1979. Food and habitat partitioning among two groups of coexisting Accipiter. PhD. Thesis, Oregon State University, Corvallis. 116 pp.

26. Reynolds, Richard T. 1983. Management of western coniferous forest habitat for nesting accipiter hawks. For. Serv. Gen Tech. Rep. RM-102. 7pp

27. Reynolds, R.T., R.A. Ryder and B.D. Linkhart. Small Forest Owls. Western Raptor Management Symposium and Workshop. pp. 134-143.

28. Ryser, F.A. Jr. 1985. Birds of the Great Basin - A natural history. University of Nevada Press. 604 pages.

29. Stebbins, R.C. 1966. A Field Guide to Western Reptiles and Amphibians. Sponsored by the Audubon Society and National Federation. Houghton Mifflin Company, Boston. 279p.

30. U.S.D.A. Forest Service. 1991. Humboldt National Forest Sensitive Plant Field Guide.

31. U.S.D.A. Forest Service. 1992. Biological Evaluation of Big Springs Exploration Project signed 6/2/92. Unpubl. On file at Mt. City Ranger Sta..

32. USFWS, Letter of 10/93 with species list for the North California Mountain project, FWS 1-5-93-SP-423. Confirmed for use on the EIS on 12/7/93 in a phone conversation with Michael Burroughs.

33. USFWS, 1993. Draft LCT Recovery Plan.

34. Wai-pong, V. and M.B. Fenton. 1989. Ecology of spotted bat roosting and foraging behavior. J. Mamm. 70(3):617-622.

35. Warder, J. 1993. Forest Service wildlife biologist. Field reviews of project area, d.o. sampling, wildlife observations.

36. Watkins, L.C. 1977. Euderma maculatum. Mammalian Species, No. 77, pp. 1-4. The American Society of Mammalogists.

37. Woodsworth, G.C., G.P. Bell and M.B. Fenton. 1981. Observations of the echolocation, feeding behavior and habitat use of Euderma maculatum in southcentral British Columbia. Can. J. Zool. 59:1099-1102.

38. Younk, J. 1992. Annual report, 1992 field season, northern goshawk study, Independence Mountains, Nevada. On file at Mt. City Ranger District office.

ADDENDUM TO JERRITT CANYON MINE EXPANSION PROJECT BE/BA

To: John Inman, Forest Supervisor

In order for the Biological Assessment/Evaluation (BAE) to reflect statements within the EIS an addendum is required. Two species that are discussed within the EIS were inadvertently left out of the BAE.

North American Lynx (Felis lynx canadensis) Sensitive and Category 2.

The lynx ranges across the boreal forest regions of North America (McCord and Cardoza 1982). The range extends into Idaho, Montana, Wyoming, central Utah and Colorado. The range is closely tied to the snowshoe hare range.

Sid Eaton, NDOW biologist and commercial trapper, has no records of Lynx in northeastern Nevada. He mentioned that the bobcats in Nevada are often called lynx cats due to their large size and good fur. Hall (1934) mentions this also in a book section entitled, Mammals Possibly Occurring in Nevada of which Satisfactory Record is Lacking. In Hall's notes for lynx he mentions there are old records of lynx being taken but no documented proof and "until an actual specimen of Lynx canadensis is forthcoming from Nevada it seems best to regard all reports of true lynxes from these as based on large individuals of the bobcat (Lynx rufus pallescens)".

Flammulated owl (Otus flammeolus) Sensitive.

The breeding range for the Flammulated Owl is the montane conifer forests of the interior west. It is considered rare to uncommon in the Great Basin (Ryser 1985) and in Nevada (Alcorn 1988). Flammulated owls are an insectivorous obligate cavity nesting species. Habitat selection by this owl is based primarily on prey abundance and secondarily on suitable nesting trees (Reynolds 1987). Foraging areas consist primarily of community types with a high abundance of insects, particularly lepidopterans (moths, butterflys). These community types are typically old growth timber stands comprising ponderosa pine (Pinus ponderosa) and/or Douglas fir (Pseudotsuga menziesii). DeGraaf (1991) states this species favors ponderosa pine forests but also occurs in spruce-fir, douglas fir, lodgepole pine, aspen and pinyon-juniper that have some undergrowth. Nesting in pinyon in western New Mexico was documented by McCallum and Gehlbach (1988).

According to Reynolds and Linkhart (1992) all reported flammulated owl nests were in forest stands containing at least some ponderosa pines mixed with oak, pinyon, firs, Douglas-fir, incense cedar or aspen. Nesting occurs in the Sierra's and has been reported (but unlikely) from Ruby Lake National Wildlife Refuge [Cave Cr. (Ryser 1985)]. Additional records (Alcorn 1988) are from Jarbidge, and in the Quinn Canyon Mountains. In the Quinn, the Flammulated owl was numerous in rather open fir/aspen/mahogany and scattered ponderosa pine at 7800' - 8000' in Scofield Canyon. Nests are 7-25' high, usually in old flicker or woodpecker nests (DeGraaf 1991). Cooler weather and decreasing prey base cause the birds to migrate.

Flammulated owls were seen/heard in the Bruneau River drainage by Ports in both 1991 and 1992. They were associated with the juniper/cottonwood community type. At this time it is nearly impossible to draw any habitat use information from this sighting, as information on the distribution of this species is limited. A sighting has been reported from the southern Ruby Mountains

(Overland Pass). A UN, Reno graduate student has identified flammulated owls in the Santa Rosa, Schell and Jarbidge ranges on the Forest (Garland 1993). This species could occur in the Independence Range where aspen occurs.

Effects to Sensitive Species

It is not thought that the lynx occurs in this portion of Nevada.

No surveys have been conducted for flammulated owls however aspen could be owl habitat in the Independence Range. Implementation of any of the action alternatives could directly affect owls by removing nesting and foraging habitat. Approximately 18% of the aspen habitat within the general study area will be impacted with the proposed activity. IMC has proposed some mitigation of this habitat loss by off-site planting, riparian fencing and stand improvement.

Determination

This project may affect individual flammulated owls but would not likely contribute toward the federal listing of this wide ranging species. This project will have no affect on the lynx.

Signature

/s/ Steve Anderson 3/25/94

STEVE ANDERSON
Forest Wildlife Biologist Date

References

-Alcorn, J. R. 1988. The birds of Nevada. Fairview West Publ., Fallon NV.
-DeGraaf, R. M., et. al. 1991. Forest and Rangeland Birds of the United States - Natural history and habitat use. USDA Agriculture Handbook 688. 625 pages.
-Eaton, Sid. 1992. NDOW biologist, personal communication, 3/92.
-Garland, S. 1993. Flammulated owl graduate study annual report.
-Hall, E. R. 1946. Mammals of Nevada. UC California Press, Berkeley. 649 pp.
-McCallum, D. A. and F. R. Gehlbach. 1988. Nest-site preferences of flammulated owls in western New Mexico. Condor 90:653-661.
-McCord, C. M., and J. E. Cardoza. 1982. Bobcat and Lynx. Pages 728-766, in Chapman, J. A. and G. A. Feldhamer, eds. Wild Mammals of North America - Biology, Management, Economics. John Hopkins Univ. Press, Baltimore. 1147 pp.
-Ports, M. 1991 and 1992. Unpubl. survey reports.
-Reynolds, R.T., and B.D. Linkhart. 1987. The nesting biology of flammulated owls in Colorado. Pages 239-248, in Biology and conservation of northern forest owls: symposium proceedings, 2/3-7/87. R. W. Nero, et. al. eds. Gen. Tech. Rep. RM-142. Fort Collins, CO. USDA Forest Service. 309 pages.
-Reynolds, R. T. and B. D. Linkhart. 1992. Flammulated owls in Ponderosa pine: evidence of preference for old growth, pgs. 166-169, in Old growth forests in the Southwest and Rocky Mountain Regions, workshop proceedings, 3/9-13/92. M. R. Kaufmann, et. al eds. Gen. Tech. Rep. RM-213. Fort Collins, CO. USDA FS.
-Ryser, F. A. Jr. 1985. Birds of the Great Basin - A natural history. University of Nevada Press. 604 pages.

Appendix E

Mule Deer Habitat Improvement Plan

MULE DEER HABITAT IMPROVEMENT PLAN
FOR
IMC MITIGATION MONEY

NEVADA DEPARTMENT OF WILDLIFE
MAY, 1993

Memorandum of Understanding

In March of 1993, a Memorandum of Understanding (MOU) was signed between the Humboldt National Forest (USFS), Independence Mining Company (IMC) and the Nevada Department of Wildlife (NDOW). The purpose of this MOU was to facilitate mitigation of impacts to National Forest Lands from mining activity in the Independence Mountains. This document specified an amount of money that would be contributed to help mitigate mining impacts occurring to mule deer habitat on National Forest Lands within the Independence Range. IMC will contribute a total of $500,000 by 1994 to a habitat fund administered by NDOW. The MOU stipulates that the money will be used to improve deer habitat, primarily within Management Area Six. The following is a plan that outlines how this money will be spent to benefit mule deer in Area Six.

BACKGROUND

The Independence Range is one of the most productive deer ranges within Nevada. The fawn ratio, which is indicative of summer habitat productivity, is the highest in the State. It is believed that prior to 1970, the Area Six deer herd was the largest in Nevada.

Exotic annual cheatgrass was introduced into the western Elko County area in the 1930's. Excessive yearlong grazing by domestic livestock in the early to mid 1900's severely reduced the perennial grass understory. This allowed for the rapid spread of the volatile cheatgrass into the sagebrush communities. Starting in the mid 1960's, large range fires began destroying large tracts of land in the southern portions of Area Six. In 1964 for example, one series of fires burned more than 300,000 acres in a five day period. Since the mid 1960's, over 70% of the crucial deer winter range in the southern portion of Area Six has burned. Thousands of additional acres of important intermediate range have also burned.

Mining has greatly accelerated within northeastern Nevada and has impacted several important areas within Area Six. Key deer winter and intermediate habitats are being altered by mining in the South Tuscarora Range and in the Independence Range. The greatest of these impacts are occurring in Jerritt Canyon where more than 3,000 acres of high quality deer habitat are expected to be disturbed in the near future.

The result of the loss of winter and intermediate ranges has been the long term decline of the Area Six deer population. Harvest data and computer modeling indicate that Area Six now supports about half of the deer that it did prior to 1970.

GOAL

The goal of the Mitigation Money from IMC is to mitigate impacts from mining on USFS lands within the Independence Range. The best opportunities for enhancing deer habitat are through the rehabilitation of crucial burned winter ranges in key areas. Other opportunities could arise in the future that would enhance deer winter habitat within Area Six. These other opportunities could include but are not limited to the purchase of property or easements on winter range or the mitigation of migration barriers.

Most of the habitat improvement work would be accomplished off National Forest System lands (NFS) because:

1) There are limited opportunities on NFS lands,

2) Deer winter range off NFS lands is important to the deer that spend some time in the Independence Mountains.

3) In considering the needs of mule deer that use the Independence Range, off-site mitigation would provide the greatest opportunity to mitigate the effects of mining.

If the over-all goal of improving deer habitat on crucial winter ranges is achieved, then it would be expected that the long term decline of the Area Six deer population would be reversed.

STRATEGIES FOR IMPROVING AND PROTECTING CRITICAL DEER HABITAT

Old Fire Rehabilitation:

The primary emphases for the next six years will be on restoring crucial deer winter ranges that have burned and have little chance of returning to a productive state on their own as close to NFS lands as possible. Cheatgrass and annual weed ranges will be seeded with perennial shrubs, grasses and forbs. In most cases, cheatgrass competition will be reduced prior to seeding. This will be accomplished primarily through mechanical means although herbicides and burning may be used on some sites. Plant species that are crucial for deer winter survival such as sagebrush, fourwing, forage kochia, and white stem rabbitbrush will be emphasized on these seedings. Plant species that reduce the risk of reoccurring range fires will also be incorporated into the seedings. The majority of work will occur within the Izzenhood and the Sheep Creek Ranges. Work may also be accomplished within the Dunphy Hills, Adobe Mountains and on the Owyhee Desert. The major criteria for selecting rehabilitation sites will be as follows: Sites will be located within crucial deer winter ranges that support very large numbers of deer, have good potential to

be rehabilitated, and have livestock management that assures adequate protection and long-term maintenance of the seeding.

Approximately 6,000 acres meeting the above criteria have been identified and are being reviewed by the Bureau of Land Management (BLM). It is unknown at this time if these projects will obtain BLM approval. The following is a preliminary schedule of projects. For each project, the likely mitigation funding source(s) is identified. For each project, federal aid, sportsmen group dollars or some other funding source may be used to maximize the acreage treated.

Fall, 1993 Rooster Comb Seeding Project, Izzenhood Range (807 acres). A combination of Barrick and IMC money will be used to fund this project. The attached addendum contains a more detailed explanation of this project.

Fall, 1994 Rooster Comb Seeding Project, Izzenhood Range (1,100 acres). A combination of Barrick and IMC money will be used to fund this project.

Fall, 1995 Northwest Izzenhood Seeding Project, Izzenhood Range (1,100 acres). A combination of Barrick and IMC money will be used.

Fall, 1996 Northwest Izzenhood Seeding Project, Izzenhood Range (1,100 acres). Mostly IMC mitigation money with some Barrick money will be used.

Fall, 1997 Northwest Izzenhood Seeding Project, Izzenhood Range (1,100 acres). IMC money will be used.

Fall, 1998 Rock Creek Seeding Project, Sheep Creek Range (1,000 acres). Combination of IMC and Dee Gold mitigation money will be used.

Additional sites have been identified as potential rehabilitation areas but have not yet been thoroughly scoped. They include:

1) Southwest Izzenhood.
2) Southwest Sheep Creek.
3) IL Ranch Burn.
4) Owyhee River, Pipeline burn.
5) Adobe Range, east side.

The over-seeding of sagebrush and forage kochia into burned sites that have a high percentage of perennial grasses present will be attempted on an experimental basis. If successful, large scale efforts using this technique can be implemented. Advantages of over-seeding these sites would be greatly reduced costs, and the ability to seed steep and rocky areas that are crucial to deer.

Rehabilitation of Current Year's Burns:

There is little doubt that more range fires will occur within crucial Area Six deer winter ranges in the near future. There may be opportunities to quickly rehabilitate some of these fires using IMC mitigation money. The advantage of current year rehabilitation is that cheatgrass competition is reduced so there is no need for disking or other control methods. The costs are substantially reduced. Criteria for determining which burns would receive funding would be as follows:

1) Burns that are located in crucial deer winter ranges that receive very heavy deer use.

2) Burns that are located in areas that have little chance of returning to productive deer habitat on their own.

3) Project areas that receive proper rest and long term livestock management.

4) Areas receiving rehabilitation funding from the Land Management agency or the Private land owner will probably have priority.

Conservation Easements or Land Acquisition:

It may be advantageous to deer to protect crucial areas through either conservation easements or through land acquisitions. With this option, it allows us to be opportunistic should a key piece of land become available for a reasonable price. At this time no specific areas are identified. However, land on the Marsh Creek Bench and on the west side of the Independence Range are extremely important and would merit consideration should an opportunity arise.

Monitoring:

Monitoring will be conducted jointly between NDOW and the USFS on fire rehabilitation projects. The purpose of monitoring will be to determine success and failures of the project as a whole and to determine if objectives are being met. Specific components of a project such as individual species establishment will also be monitored.

For the purpose of this plan, planted shrub species will be the primary component monitored to determine project success. The "FREQDENS" method will most likely be the primary monitoring technique used. This method monitors initial establishment and the persistence of seeded species. Three vegetation attributes are sampled with four study techniques. The sampling techniques are Nested Plot Frequency, Plot Density, Point Cover, and 1/100 Acre Shrub density.

Establishing criteria that will be used in monitoring is difficult. Every site is different and the degree of success will vary. Also, species are being planted that will naturally reproduce. What may not be considered a successful established stand in the initial years may reproduce to an acceptable stand in future years.

Criteria for determining the success of a seeding was obtained from the USFS Intermountain Research Station located in Provo, Utah. By the end of the third summer of the seeding, a density of 400-500 plants/acre is considered a seeding that should be able to fully establish itself within the near future. The uniformity of a stand is also a key criteria that will be looked at to determine the success of a seeding.

ADDITIONAL OPPORTUNITIES

The mitigation money provides opportunities other than direct habitat improvement. Some of the major opportunities available are as follows:

1) Rehabilitate three acres in the southern winter ranges for every acre disturbed on the west side of the Independence Range. Analysis using deer survey data collected over a long period of time indicate that winter range on the west side of the Independence Range supports over three times the deer that even the best unburned southern winter ranges support. Therefore, using IMC money and other potential funding sources, a three to one ratio will be strived for when rehabilitating southern winter ranges.

2) Strive to reduce the cheatgrass/fire cycle within crucial deer winter ranges. It would be a wasted effort if burned ranges were rehabilitated only to have them burn again in the near future. Money will be expended within deer winter range projects and in crucial unburned areas to reduce the likelihood of fire. It is believed that the mitigation money can contribute to the overall reduction of cheatgrass dominated lands and can ultimately help reverse the cheatgrass/fire cycle.

3) Develop better and more cost effective methods for rehabilitating unproductive sites. Very little work has been accomplished in Nevada in rehabilitating cheatgrass dominated sites. The IMC mitigation money provides the opportunity to develop and improve methods for very large scale and long-term projects. Other species of wildlife as well as watersheds and domestic livestock operations will benefit as a result of cheatgrass conversions to perennial vegetation.

4) Provide incentive to encourage other funding sources. Other avenues of funding will be explored to match with the IMC Mitigation money. The combination of funding sources will maximize habitat improvement for deer.

5) Use Mitigation money to start a long-term fund that will be used to provide long-term funding for habitat projects. It is hoped that the Mitigation Money from IMC can be used as an incentive to establish a viable long-term account. This account would be self sustaining by producing enough interest to fund large scale projects on a yearly basis. In order for this concept to work, other large funding sources will have to be added to this account.

6) Ensure this mitigation plan is flexible. Environmental conditions are dynamic and can change rapidly. Other projects that will be of a greater benefit to deer may arise in the future. It is critical that other options for spending this money be constantly explored. The projects that will maximize deer habitat will be funded whether they occur on Forest, BLM or private lands.

CONCLUSION

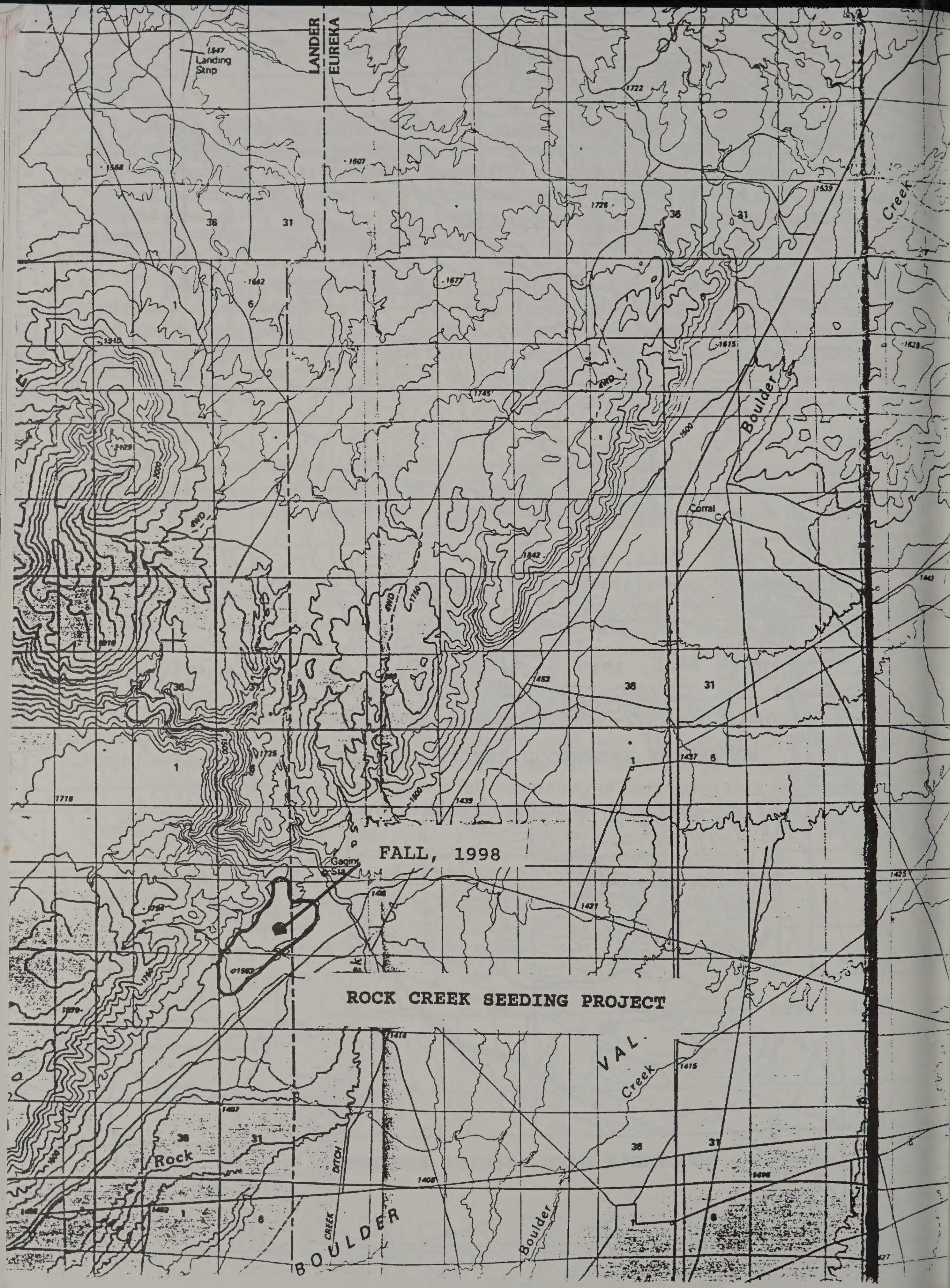
It will take between eight and 15 years before rehabilitated areas become fully productive for deer. It is expected that the Area Six deer population will continue its downward trend until a significant number of these rehabilitated acreages become productive.

This plan is designed to be flexible. It is important that we have the ability to build on successes and learn from failures. It is critical that we have the ability to quickly respond to opportunities should they become available. Above all else, it is imperative that we maximize the improvement of deer habitat to the best of our abilities through these funds.

NDOW will produce an annual report to the USFS, IMC, and other involved or interested parties by the first day in January of each year. This report will specify what has been accomplished in the proceeding year and what will be accomplished in the following year. It will also give a full accounting of the money that has been spent to date. In addition, it will provide an update on all projects that have been previously completed.

The Forest Service needs to be involved throughout the entire mitigation process to assure that their objectives and responsibilities are being met.

FALL, 1995
FALL, 1996
FALL, 1997
NORTHWEST IZZENHOOD SEEDING PROJECT
FALL, 1994
FALL, 1993
ROOSTER'S COMB SEEDING PROJECT
Creek
Spring
Roosters Comb
Izzenhood Gap
Rock



FALL, 1998
ROCK CREEK SEEDING PROJECT
LANDER
EUREKA
Landing Strip
Boulder
Creek
Corral
Gaging Sta
4WD
Rock
DITCH
CREEK
BOULDER
VAL

Appendix F

Surface Water Sampling and Water Quality Criteria and Standards

Appendix F Contents:

Appendix F

Surface Water Sampling and Water Quality Criteria and Standards

Appendix F Contents

Table F.1 Summary of Water [illegible]

Table F.2 Summary of [illegible]

[illegible]

Table F.4 Summary of [illegible]

TABLE F.1
SUMMARY OF MONTHLY WATER QUALITY MONITORING
JERRITT CANYON PROJECT, 1978-79

	JERRITT CREEK (#1)			SOUTH FORK JERRITT CREEK (#2)		
PARAMETERS	MAX	MIN	AVERAGE	MAX	MIN	AVERAGE
Temperature (°c)	25	8	13.5	25	1.0	9.9
pH (s.u.)	8.2	7.2	7.8	8.4	7.10	7.9
Dissolved Oxygen	9.5	7.5	8.5	15.8	8.1	10.6
Total Alkalinity as $CaCo_3$	240	105	167	260	110	183
COD	12.8	4.4	8.5	11.0	<2.0	7.1
Color (color units)	70	<1	27	50	0	12
Turbidity (NTU)	132	0.2	22.2	67	0	8.23
Total Dissolved Solids	400	116	254	310	135	228
Ammonia	1.05	0.1	0.40	1.33	0.1	0.56
Nitrate	13.5	<1.0	6.91	15.55	<0.1	7.36
Cyanide	<1.0	<0.1	<0.32	<1.0	<0.01	<0.14
Total P	7.6	0.1	1.91	3.22	<0.01	0.86
Calcium	65.0	22.4	47.1	75.32	23.5	49.6
Magnesium	43.0	12.5	25.3	33.1	12.5	23.3
Potassium	95.5	0.9	13.6	2.39	0.6	1.66
Sodium	9.6	3.8	5.8	10.1	4.1	6.57
Sulfate	79.8	7.29	43.8	68.9	1.92	39.5
Fluoride	0.3	0.02	0.15	0.4	<0.01	0.18
Chloride	2.8	0.1	0.84	3.0	0.5	1.76
Aluminum	5.45	<0.1	1.84	3.94	<0.1	1.35
Boron	0.1	<0.01	0.05	0.29	<0.01	0.11
Beryllium	0.12	<0.01	0.02	<0.05	<0.01	0.015
Cadmium	<0.01	<0.001	<0.008	<0.01	<0.001	<0.006
Chromium	0.16	<0.01	0.055	0.52	0.001	0.09
Copper	0.11	0.001	0.023	0.05	<0.01	0.03
Iron	10.8	0.22	2.65	9.38	0.02	2.22
Lead	0.01	<0.001	0.008	<0.01	<0.001	0.008
Mercury	0.011	<0.001	0.003	0.012	<0.001	0.002
Nickel	0.20	<0.01	0.09	0.20	<0.01	0.073
Selenium	<0.1	<0.001	<0.017	<0.01	<0.001	<0.006
Zinc	-	-	-	0.50	0.02	0.302
Total Coliform (MPN/100ml)	790	130	292(1)	54,000	0	-
Fecal Coliform (MPN/100ml)	330	0	-	490	0	-

NOTE: All units are mg/l unless otherwise noted. For averages, values below detection are assumed to be equal to the detection limit.
(1) Geometric mean, cannot be computed for zero values.

Source: Environmental Research Technology, Inc., August 1979b. Water Quality Technical Report for the Jerritt Canyon Project.

TABLE F.1 (continued) SUMMARY OF MONTHLY WATER QUALITY MONITORING JERRITT CANYON PROJECT, 1978-79						
	JERRITT CREEK AT HIGHWAY 11 (#13)			JERRITT CREEK AT BASE CAMP (#17)		
PARAMETERS	MAX	MIN	AVERAGE	MAX	MIN	AVERAGE
Temperature (°c)	19	15	17	17	0	8.7
pH (s.u.)	8.6	7.5	8.1	8.4	7.1	7.7
Dissolved Oxygen	8.6	8.5	8.6	13.2	8.0	9.9
Total Alkalinity as $CaCo_3$	105	100	102.5	215	19.5	167
COD	18.4	16.5	17.4	9.7	3.0	8.0
Color (color units)	54	38	45.7	26	0	6.51
Turbidity (NTU)	24	11	16.8	12	0	2.38
Total Dissolved Solids	154	115	131	244	147	212
Ammonia	0.45	0.2	0.32	1.4	0.05	0.35
Nitrate	5.1	2.4	4.13	15.55	<0.1	4.91
Cyanide	<1.0	<0.01	0.37	<1.0	<0.01	<0.15
Total P	3.23	0.3	1.92	1.63	<0.01	0.82
Calcium	30.2	27.2	28.9	68.6	36.3	49.9
Magnesium	10.5	5.7	7.7	28.0	10.4	20.0
Potassium	4.6	2.9	3.7	3.18	0.8	1.58
Sodium	11.0	9.1	10.3	12.0	0.4	5.93
Sulfate	7.9	4.8	6.4	41.72	10.5	28.4
Fluoride	0.1	0.1	0.1	0.18	<0.01	0.14
Chloride	5.0	0.2	1.93	3.50	0.2	1.55
Aluminum	2.37	0.38	1.21	2.32	<0.10	0.85
Boron	0.13	<0.01	0.07	0.17	<0.01	0.09
Beryllium	<0.01	<0.01	<0.01	<0.10	<0.01	0.03
Cadmium	<0.01	<0.01	<0.01	<0.01	<0.001	<0.007
Chromium	0.10	0.04	0.073	0.10	0.001	0.028
Copper	0.33	<0.01	0.12	0.19	<0.01	0.043
Iron	6.80	0.36	2.61	2.6	0.04	0.70
Lead	0.01	<0.01	0.01	<0.01	<0.001	<0.008
Mercury	0.011	<0.001	0.004	0.074	<0.001	0.008
Nickel	0.30	<0.10	0.17	0.12	<0.01	0.06
Selenium	<0.01	<0.001	<0.007	<0.01	<0.001	<0.006
Zinc	15.1	0.03	5.57	1.84	0.02	0.34
Total Coliform (MPN/100ml)	630	0	-	170,000	50	705[(1)]
Fecal Coliform (MPN/100ml)	0	0	-	170,000	0	-

NOTE: All units are mg/l unless otherwise noted. For averages, value below detection are assumed to be equal to the detection limit.
[(1)] Geometric mean, cannot be computed for zero values.

Source: Environmental Research Technology, Inc., August 1979b. Water Quality Technical Report for the Jerritt Canyon Project.

TABLE F.1 (continued)
SUMMARY OF MONTHLY WATER QUALITY MONITORING
JERRITT CANYON PROJECT, 1978-79

PARAMETERS	BURNS CREEK (#6)			MILL CREEK (#7)			BURNS CREEK AT HIGHWAY 11 (#11)		
	MAX	MIN	AVERAGE	MAX	MIN	AVERAGE	MAX	MIN	AVERAGE
Temperature (°c)	15	0.1	7.7	20	5.0	13.2	17	10	13.5
pH (s.u.)	8.35	7.30	7.9	8.15	6.2	7.6	8.2	8.2	8.2
Dissolved Oxygen	13.0	7.9	10.1	11.8	7.7	9.5	10.7	8.4	9.6
Total Alkalinity as $CaCo_3$	260	105	185	240	120	158	195	190	192
COD	8.64	<0.02	3.97	10.6	3.8	6.6	11.5	9.9	10.7
Color (color units)	49	0	8.6	33	<1	17.6	72	36	54
Turbidity (NTU)	10	0	1.58	7.0	<1	3.7	37	6	21.5
Total Dissolved Solids	235	134	199	314	187	238	227	129	178
Ammonia	1.17	0.08	0.46	0.57	0.1	0.32	1.17	0.2	0.68
Nitrate	14.06	<0.1	5.11	15.9	0.4	8.5	5.3	3.7	4.5
Cyanide	<1.0	<0.01	<0.16	<1.0	<0.10	<0.28	<1.0	<0.10	<0.55
Total P	2.0	<0.01	0.57	2.27	0.20	1.31	3.10	2.27	2.68
Calcium	62.06	33.2	46.7	60.5	38.4	49.02	26.3	4.94	15.6
Magnesium	27.5	11.6	20.4	28.0	16.0	22.2	31.1	10.2	20.6
Potassium	1.50	0.097	0.70	1.8	0.6	1.2	1.7	1.3	1.5
Sodium	6.2	3.0	4.28	7.5	3.7	5.2	5.6	4.8	5.2
Sulfate	29.4	3.9	19.2	91.2	32.8	56.1	21.4	18.0	19.7
Fluoride	0.3	<0.01	0.11	0.10	0.03	0.11	0.10	0.10	0.10
Chloride	2.10	0.2	1.08	2.9	0.1	0.80	0.4	0.2	0.3
Aluminum	1.23	<0.1	0.84	1.27	0.48	0.92	1.18	0.88	1.03
Boron	0.15	<0.01	0.09	0.08	<0.01	0.05	0.09	<0.01	0.05
Beryllium	<0.10	<0.01	0.03	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cadmium	<0.01	<0.001	<0.007	<0.01	<0.001	<0.008	<0.01	<0.01	<0.01
Chromium	0.09	<0.001	0.031	0.09	<0.01	0.03	0.01	0.02	0.015
Copper	0.29	<0.01	0.053	0.06	<0.01	0.02	0.07	0.03	0.05
Iron	8.39	0.01	1.45	6.51	0.46	2.22	7.90	0.026	3.96
Lead	0.07	<0.001	0.013	0.28	<0.001	0.06	0.01	<0.01	0.01
Mercury	0.002	<0.001	0.001	0.001	<0.001	0.001	0.008	<0.001	0.004
Nickel	0.35	0.01	0.083	9.50	<0.01	1.96	0.13	<0.10	0.115
Selenium	<0.01	<0.001	<0.006	<0.01	<0.001	<0.005	<0.01	<0.001	<0.006
Zinc	4.77	0.04	0.792	0.15	0.05	0.078	0.83	0.09	0.46
Total Coliform (MPN/100ml)	1700	0	---	1300	0	---	490	490	490[1]
Fecal Coliform (MPN/100ml)	20	0	---	490	0	---	230	220	225[1]

NOTE: All units are mg/l unless otherwise noted. For averages, value below detection are assumed to be equal to the detection limit.
[1] Geometric mean, cannot be computed for zero values.

Source: Environmental Research Technology, Inc., August 1979b. Water Quality Technical Report for the Jerritt Canyon Project.

TABLE F.2 SUMMARY OF WATER QUALITY MONITORING JERRITT CANYON PROJECT, 1981-92						
	JERRITT CREEK (JC)			JERRITT CREEK (JC-2)		
PARAMETERS	MAX	MIN	AVERAGE	MAX	MIN	AVERAGE
Discharge (cfs)	16.85	0.0	1.036	0.0	0.0	0.0
pH (s.u.)	8.60	7.50	8.11	8.67	8.32	8.50
Electrical Conductivity (hmos/cm)	841	180	413	515	480	550
Total Dissolved Solids	540	121	258	367	323	345
Total Suspended Solids	206	1	22	14	1	8
Turbidity (NTU)	85.0	0.0	10.3	3.0	0.2	1.6
Total Alkalinity as $CaCo_3$	275	85	165	169	148	159
Carbonate as $CaCO_3$	28	0	2	12	2	7
Bicarbonate as $CaCO_3$	275	85	163	167	136	152
Sodium	11.0	3.0	6.8	32.0	6.7	19.4
Chloride	25.9	0.4	5.7	9.0	8.0	8.5
Magnesium	42.0	11.0	22.2	32.0	29.2	30.6
Arsenic	0.003	0.001	0.002	0.001	0.001	0.001
Calcium	85.1	25.1	46.4	62.0	59.8	60.9
Sulfate	235	19	61	121	100	111
Nitrate	8.8	<0.01	1.4	0.70	0.10	0.40
Total P	0.20	0.02	0.12	0.04	0.02	0.03
Iron	0.79	0.02	0.14	0.02	0.02	0.02

NOTE: All units are mg/l unless otherwise noted.

Source: IMC, 1981-1992. Surface Water Sampling Program.

TABLE F.2 (continued)
SUMMARY OF WATER QUALITY MONITORING
JERRITT CANYON PROJECT, 1981-92

	BURNS CREEK #1 (BC-1)			BURNS CREEK #2 (BC-2)			BURNS CREEK #3 (BC-3)		
PARAMETERS	MAX	MIN	AVERAGE	MAX	MIN	AVERAGE	MAX	MIN	AVERAGE
Discharge (cfs)	2.125	0.0	0.178	0.0	0.0	0.0	14.6	0.0	4.631
pH (s.u.)	8.4	7.20	7.96	8.2	7.8	8.05	8.6	7.6	8.26
Electrical Conductivity (hmos/cm)	525	310	407	490	375	445	525	320	440
Total Dissolved Solids	607[(1)]	168	295	238	193	215	601[(1)]	170	253
Total Suspended Solids	1690	1	278	17	1	16	136	1	9
Turbidity (NTU)	600	0.1	77.2	1.4	0.5	1.0	82.0	0.03	3.86
Total Alkalinity as $CaCo_3$	260	130	176	213	167	196	239	125	199
Carbonate as $CaCO_3$	4	0	0	0	0	0	18	0	3
Bicarbonate as $CaCO_3$	260	130	176	213	167	196	221	125	196
Sodium	8.7	3.8	5.8	6.0	4.0	4.8	17.6	1.0	5.3
Chloride	14.0	2.0	4.8	12.0	3.0	7.5	12.0	2.0	4.4
Magnesium	29.0	10.0	18.5	19.8	15.1	18.1	29.0	12.5	22.3
Arsenic	0.013	0.001	0.005	0.012	0.006	0.008	0.014	0.001	0.009
Calcium	54.0	35.0	42.6	47.8	38.2	44.4	57.7	29.8	49.4
Sulfate	41	8	25	21	11	14	56.0	16.0	29.3
Nitrate	2.4	0.1	0.6	0.1	0.1	0.1	3.2	0.1	0.3
Total P	1.00	0.04	0.25	0.20	0.05	0.12	0.35	0.01	0.04
Iron	6.80	0.02	0.97	0.04	0.02	0.03	0.34	0.00	0.04
Mercury	ND	ND	ND	ND	ND	ND	0.0005	0.0005	0.0005

NOTE: All units are mg/l unless otherwise noted.

[(1)]Sample taken 7/23/91.

Source: IMC, 1981-1992. Surface Water Sampling Program.

Table F.3
Water Quality Criteria and Standards for Nevada

Parameter[1] (mg/L)	Drinking Water Std.		Surface Water Standards to Protect Beneficial Uses As Established in NAC 445.117 to 445.13976					
	Primary	Secondary	Municipal or Domestic Supply	Aquatic Life		Agriculture		Wildlife Propagation
				1 Hr. Ave.	96 Hr. Ave.	Irrigation	Stock Water	
Arsenic	0.05	-	0.05	0.36 As(III)	0.19 As(III)	0.1	0.2	-
Barium	2.0	-	0.1	-	-	-	-	-
Beryllium	-	-	0	-	-	0.1	-	-
Boron	-	-	-	0.55	0.55	0.75	5.0	-
Cadmium	0.05	-	0.01	[2]	[2]	0.01	0.05	-
Chromium	0.05	-	0.05	0.016 Cr(VI)	0.0011 Cr(VI)	0.1	1.0	-
Copper	-	1.0	-	[2]	[2]	0.2	0.5	-
Iron	-	0.6	-	1.0	1.0	5.0	-	-
Lead	0.05	-	0.05	[2]	[2]	5.0	0.1	-
Manganese	-	0.1	-	-	-	0.2	-	-
Mercury	0.002	-	0.002	0.0024	.000012	-	0.01	-
Nickel	-	-	0.0134	[2]	[2]	0.2	-	-
Selenium	0.01	-	0.01	0.020	0.005	0.02	0.05	-
Silver	-	-	0.05	[2]	[2]	-	-	-
Thallium	-	-	0.013	-	-	-	-	-
Zinc	-	5.0	-	[2]	[2]	2.0	25.0	-
Cyanide (WAD)	-	-	0.2	0.022	0.0052	-	-	-

Parameter[1] (mg/L)	Drinking Water Std.		Surface Water Standards to Protect Beneficial Uses As Established in NAC 445.117 to 445.13976					
	Primary	Secondary	Municipal or Domestic Supply	Aquatic Life[3]		Agriculture		Wildlife Propagation
				Propagation	Put & Take	Irrigation	Stock Water	
Alkalinity	-	-	-	less than 25% change		-	-	30-130
Chloride	-	400	400	-	-	-	1500	1500
Color (PCU)	-	15	75	-	-	-	-	-
Dissolved Oxygen	-	-	Aerobic	5.0	5.0	-	Aerobic	Aerobic
Fluoride	4.0	2.0	-	-	-	1.0	2.0	-
Nitrate as N	10	-	-	90(w)	90(w)	-	100	100
ph (SU)	-	6.5-8.5	5.0-9.0	6.5-9.0	6.5-9.0	4.5-9.0	5.0-9.0	7.0-9.2
Sulfate	-	500	500	-	-	-	-	-
Temp °C	-	-	-	site specific determination		-	-	-
TDS	-	1000	1000	-	-	-	3000	-
TSS	-	-	-	25-80	25-80	-	-	-
Turbidity (NTU)	1.0[4]	-	-	50(w);10(c)	50(w);10(c)	-	-	-

Sources: NAC 445.117; NAC 445.1339, Steve Brockway, Nevada Health Protection Services

Notes:
1 mg\L = milligrams per liter; PCU = Photoelectric color units; SU = standatandard units; NTU = nephelometric turbidity units; TDS = total dissolved solids; TSS = total suspended solids; C = degrees Celsius.
2 Parameter dependent on hardness; see NAC 445.1339 for equations to determine concentration.
3 (w) refers to warm water and (c) is for cold water. No letter designation indicates criteria are common to both warm and cold water.
4 for surface water only

Table F.4
Standards of Water Quality
South Fork Owyhee River
(Control Point at Petan Access Road)

Parameter	Requirements to Maintain Existing Higher Quality	Standards of Water Quality For Beneficial Uses	Beneficial Uses
Temperature °C Maximum[a] ΔT°C	$\Delta T = 0°$	May-Oct < 21° Nov-Apr < 13° $\Delta T < 1°$	Aquatic life, water contact recreation
pH Units	-pH = 0.5	6.5 - 9.0	Aquatic life, municipal & domestic supply, water contact recreation
Total Phosphorus (as P) in mg/l	--	< 0.1	Aquatic life, water contact recreation, municipal & domestic supply, noncontact recreation
Nitrogen Species (as N) in mg/l	Nitrate S.V. < 1.0	Nitrate S.V. < 10 Nitrite S.V. < 0.06 Ammonia S.V. < 0.02 (un-ionized)	Municipal & domestic supply, aquatic life, water contact recreation, noncontact recreation
Dissolved Oxygen in mg/l	--	> 6.0	Aquatic life, water contact recreation, wildlife propagation, stock watering, municipal & domestic supply, noncontact recreation
Suspended Solids - mg/l	--	S.V. < 25	Aquatic life, municipal & domestic supply
Turbidity - NTU	--	S.V. < 10	Aquatic life, municipal & domestic supply
Total Dissolved Solids - mg/l	S.V. < 280	S.V. < 500	Municipal & domestic supply, irrigation, stock watering
Chlorides - mg/l	S.V. < 15.0	S.V. < 250	Municipal & domestic supply, wildlife propagation, irrigation, stock watering
Alkalinity (as CO_3) - mg/l	--	< 25% change from natural conditions	Aquatic life, wildlife propagation
Fecal Coliform No./100ml	--	< 200/400[b]	Water contact recreation, noncontact recreation, municipal & domestic supply, irrigation, wildlife propagation
Color	--	c	Municipal or domestic supply

Source: NDEP 1992.

Note: a) Maximum allowable increase in temperature above water temperature at the boundary of an approved mixing zone, but the increase must not cause a violation of the single value standard.
b) The annual geometric mean must not exceed 200 per 100 milliliters nor may the number of fecal coliform in a single sample exceed 400 per 100 milliliters.
c) Increase in color must not be more than 10 color units above natural conditions.

(Added to NAC by Environmental Commin. eff. 09/20/90)

BLM Library
Denver Federal Center
Bldg. 50, OC-521
P.O. Box 25047
Denver, CO 80225